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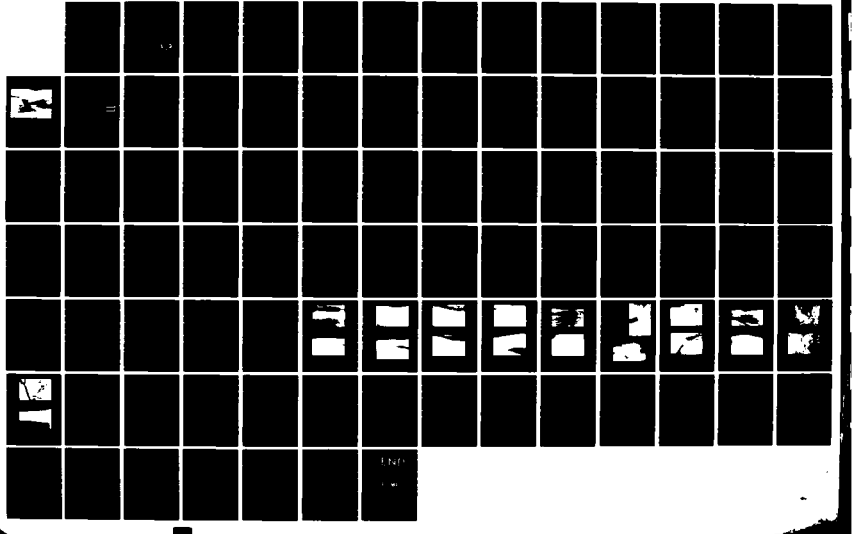
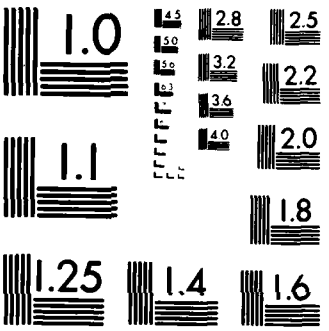




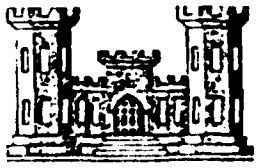
MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS 1963-A

CONNECTICUT RIVER BASIN
LUDLOW, VT

JEWELL BROOK DAM SITE NO. 3
VT 00016
VT 00262

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

APRIL 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Connecticut River Basin
Ludlow, VT.
Parker Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

THe dam is an earth embankment consisting of a main dam and a saddle dike. A dam failure analysis was performed for each of the two potential downstream damage areas. The dam is judged to be in fair condition due to the questionable durability of the grassed emergency spillway during flood flows. It is intermediate in size with a high hazard potential. The test flood will be equivalent to the PMF. There are various recommendations which should be undertaken by the owner.

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REPLY TO
ATTENTION OF:
NEDED

AUG 26 1980

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, Vermont 05602

Dear Governor Snelling:

Inclosed is a copy of the Jewell Brook Dam Site No. 3 Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Water Resources, the cooperating agency for the State of Vermont. In addition, a copy of the report has also been furnished the owner, Town of Ludlow, Ludlow, Vermont 05149.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Water Resources for your cooperation in carrying out this program.

Sincerely,

Max B. Scheider

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT
BRIEF ASSESSMENT

Identification Number:	VT00016 Dam & VT00262 Dike
Name of Dam:	Jewell Brook Site No. 3
Town:	Ludlow
County and State:	Windsor, Vermont
Stream:	Parker Brook
Date of Inspection:	November 1, 1979

Jewell Brook Site No. 3 Dam is an earth embankment consisting of a main dam and a saddle dike. The saddle dike and the main dam each have an independent potential damage area located downstream. Therefore, the project was assigned two identification numbers: (VT00016) for the main dam and (VT00262) for the saddle dike. A dam failure analysis was performed for each of the two potential downstream damage areas.

The structure was constructed in 1970 as a multiple purpose structure (flood control - recreation). The main structure consists of zoned, compacted earthfill embankment with a cutoff trench to rock or till in the foundation. It has a top width of 18 feet and is approximately 650 feet long and 65 feet high and has 3H:1V and 2.5H:1V upstream and downstream slopes, respectively. The saddle dike, located on the south side of the reservoir (right side of main dam), is approximately 325 feet long and 17 feet high. The principal spillway consists of a two-stage reinforced concrete intake structure that connects to a 30-inch diameter discharge conduit. A reservoir drain at the bottom of the intake structure also connects to the conduit. The emergency spillway is a 200-foot wide grassed channel in the left abutment.

The dam is judged to be in fair condition due to the questionable durability of the grassed emergency spillway during flood flows. All of the aspects of the dam were in good condition. The inspection revealed some minor localized erosion, the poor condition of the rope ladder attached to the concrete intake structure and the unmowed condition of the steeper slopes.

In accordance with Corps of Engineers Guidelines for the Intermediate size and High hazard classification of the dam, the test flood will be equivalent to the Probable Maximum Flood (PMF). Peak inflow to the reservoir is 3,300 cubic feet per second (cfs); peak outflow is 2,600 cfs with 4.6 feet of freeboard. With a water level at the crest of the dam, the capacity of the spillways is 12,450 cfs, which is equivalent to 480 percent of the routed test flood outflow.

It is recommended that the owner engage a registered engineer to review the design of the erosion potential of the emergency spillway to ensure that it can pass the test flood without excessive erosion. The Soil Conservation Service has modified its design guidelines pertaining to the design of earth spillways since the construction of the dam. Recommendations should be made by the engineer and implemented by the owner.

In addition, the owner should implement a systematic maintenance program consisting of the following items:

1. Mow all slopes on an annual basis.

2. Inspect for erosion and repair annually.

3. Remove debris from the low level intake on the concrete intake structure at intervals of not more than three months.

4. Establish written procedures for operating and maintaining the dam.

5. Develop a formal downstream warning and surveillance plan.

The recommendations and remedial measures are described in detail in Section 7. They should be addressed within one year after receipt of this Phase I Inpsection Report by the owner.

Very truly yours,

DuBois & King, Inc.

John J. Bilotta, P.E.
Project Manager

JJB/chj

This Phase I Inspection Report on Jewell Brook Dam Site No. 3 has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably-possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that

a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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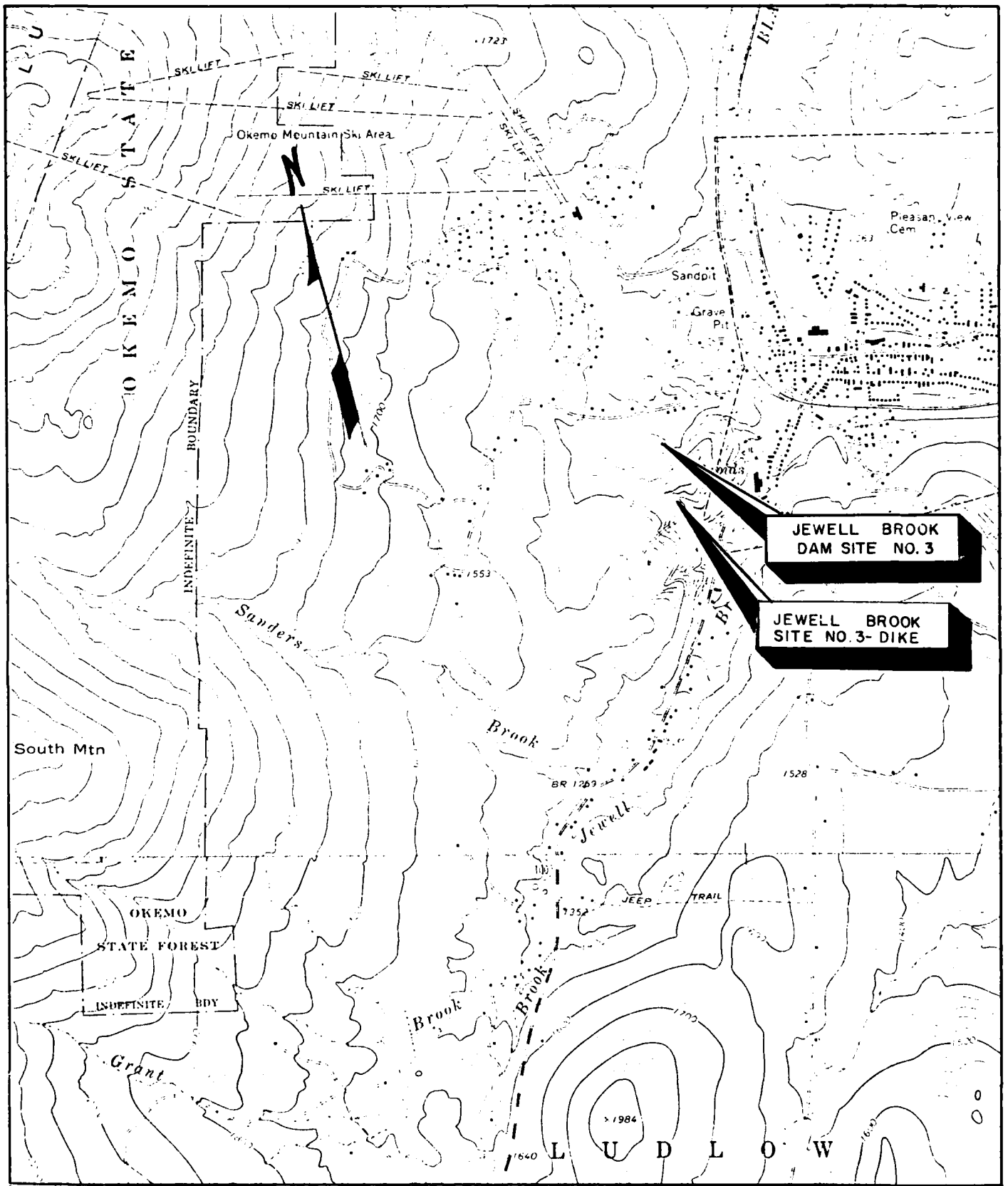
JEWELL BROOK DAM SITE NO. 3



DuBois & King INC.

NATIONAL DAM INSPECTION PROGRAM

JEWELL BROOK DAM SITE **NO. 3**

LOCATION MAP

USGS QUAD. LUDLOW, ANDOVER VERMONT

DRAWN BY: JAS	DATE: 2/80
CHECKED BY: PMC	PROJ NO: 91113
PROJ ENG	DRAW NO
SCALE: 1"= 24000	

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
JEWELL BROOK SITE NO. 3 DAM
SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. DuBois & King, Inc., has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to DuBois & King, Inc., under a letter of October 19, 1979, from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0003 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams, to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

(2) To encourage and prepare the states to quickly initiate effective dam safety programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Jewell Brook Site No. 3 Dam is located in the Town of Ludlow, Windsor County, Vermont. The dam is located on Parker Brook approximately 1600 feet upstream from its confluence with Jewell Brook. The dam is shown on the 7.5 minute USGS quadrangle for Ludlow, Vermont, with appropriate coordinates being 72° 42.8' west longitude, 43° 23.5' north latitude. The location of Jewell Brook Site No. 3 Dam is shown on the location map immediately preceding this page.

b. Description of Dam and Appurtenances. Jewell Brook Site No. 3 Dam is an earth embankment consisting of a main dam and a saddle dike. The main dam is a zoned, compacted, earth fill with a cutoff trench to rock or till into the foundation. A drainage system is located under the downstream portion of the earth fill to collect seepage. The main dam has a top width of 18 feet and is approximately 650 feet long and 65 feet high. The downstream slope and upstream slope of the main dam are grassed and have side slopes of 2.5H:1V and 3H:1V, respectively. A 10-foot wide berm is located part way up the slopes of both the downstream and upstream slopes of the main dam. The saddle dike is located on the south side of the reservoir (to the right of the main dam), and its axis is perpendicular to the axis of the main dam. A 100-foot long section of natural ground lies between the dam and dike. The saddle dike has a top width of 12 feet, is approximately 325 feet long and 17 feet high, and has a cut-off trench of glacial till. The slopes of the saddle dike are 3H:1V upstream, 2H:1V downstream, and are grassed. Two spillways provide flow control, a principal spillway for normal flow and an emergency spillway

for overflow. The principal spillway consists of a two-stage reinforced concrete intake structure and a 30-inch diameter conduit which is located near the center of the main dam. The 30-inch diameter conduit passes through the earth embankment on a slight skew angle bearing towards the right abutment. A reservoir drain is connected to the intake structure by a gated, 18-inch diameter conduit. The emergency spillway is a 200-foot wide grassed channel in the left abutment.

c. Size Classification. Jewell Brook Site No. 3 is 65 feet high and has a storage capacity of 492 acre-feet. In accordance with article 2.1.1 of the Recommended Guidelines for Safety Inspection of Dams, the dam is Intermediate in size based upon its height, which is greater than 40 feet and less than 100 feet.

d. Hazard Classification. Jewell Brook Site. No. 3 has a hazard classification of High based upon its potential for damage if breached. The saddle dike and the main dam each have independent potential damage areas located downstream. Development downstream of Jewell Brook Site No. 3 Dam consists of approximately 20 dwellings located along State Route 100 near the confluence of Jewell Brook and Parker Brook. Approximately .4 miles downstream lies the Village of Ludlow. In the Village, many residences and commercial establishments are built in the flood plain of Jewell Brook. The flood wave generated by a breach of the main dam would produce a stage of 15.0 feet above stream bed when it reaches the confluence of Parker Brook and Jewell Brook. The resulting 11-foot high flood wave would have the potential of washing out a railroad bridge and a highway bridge on State Route 100 in Ludlow and causing appreciable damage to 15 to 20 dwellings along Jewell Brook with flood levels up to five feet above the first floor of of those dwellings. It is likely that more than a few lives may be lost if the main dam is breached.

Located downstream of the saddle dike is a natural gully. The gully terminates at an open field located on the west bank of Jewell Brook. There are approximately four to six buildings (includes dwellings and farm buildings) which are located in the gully. The flood wave generated by a breach of the saddle dike would be approximately 4.4 feet high. It is expected that this 4.4-foot flood wave would not cause any damage to any dwellings with a flood height level with the first floor of one dwelling. It is expected that the energy of this flood wave would be almost totally dissipated by the time it reached the open field located approximately one-quarter mile downstream. It is likely that no lives would be endangered if the saddle dike were breached.

e. Ownership. This dam is owned by the Town of Ludlow, Vermont 05149.

f. Operator. The dam is operated and maintained by the Town of Ludlow, Vermont 05149. Mr. Dean Brown, Town Manager, is in charge of all Town equipment. His telephone number is 802/228-2841.

g. Purpose. Jewell Brook Site No. 3 Dam is a multiple-purpose dam. It provides flood protection for the Jewell Brook flood plain area, and it forms an impoundment of water for recreational use.

h. Design and Construction History. The Jewell Brook Site No. 3 Dam, was constructed in 1970. The dam was designed by the Soil Conservaton Service for the Town of Ludlow. The construction of the dam was funded under the authority of the Watershed Protection and Flood Protection Act (Public Law 566, 83rd Congress; 68 Stat. 666) as amended. The Town of Ludlow paid for the acquisition of the required land, easements, and rights-of-way.

i. Normal Operating Procedure. The operation of Jewell Brook Site No. 3 Dam is automatic. During low flows, the water level is controlled by the hydraulic capacity of the low stage orifice (elevation 1230.0 NGVD, 21.5 ft. below dam crest) of the principal spillway. As inflow increases the capacity of the orifice spillway is exceeded causing the water surface to rise. The high stage inlet of the principal spillway and the emergency spillway become operational at elevations 1239.7 and 1243.9 NGVD, (11.8 ft. and 7.6 ft. below dam crest) respectively.

1.3 Pertinent Data

a. Drainage Area. The drainage area of Jewell Brook Site No. 3 is 1.3 square miles. The terrain is mostly forested and is steep and mountainous. Topographic elevations in the watershed range from about 1530 to 3340. The basin is sparsely populated and there are very few houses and roads. The western portion of the drainage basin includes lands of Okemo State Forest. This land is very steep and has slopes up to 30%. The north and west shores of the pool are used for recreation. The majority of the recreational facilities (bathhouse, beach, boat dock and picnic area) are located on the north shore. The west shore is primarily used as a camping area.

The normal pool area and maximum pool area of the Jewell Brook Site No. 3 Dam represents approximately 1.1% and 2.6% of the total drainage area, respectively.

b. Discharge at Dam Site

(1) Outlet Works. A 30-inch diameter reinforced concrete conduit is located in the center of the dam. Based on as-built drawings, the conduit is 273 feet long, has a slope of .076 feet per foot and has 16 reinforced concrete anti-seep collars. A reinforced concrete intake structure controls inflow into the conduit. The low stage inlet, which consists of a rectangular orifice (1 x 1.4 foot) and trash rack is located 21.8 feet below the top of the dam. The high stage inlet which consists of two 7.5 feet long weirs, each preceded by trash racks, has a crest elevation 1239.7 which is approximately 11.8 feet below the top of dam. The maximum capacity of the 30-inch diameter conduit is approximately 150 cfs, with a water elevation at the crest of the dam (el. 1251.5). A reservoir drain, consisting of an 18-inch diameter conduit with a manually operated gate is connected to the bottom of the intake structure. The invert of the drain is at El. 1205.86 NGVD (45.6 ft. below the dam crest).

The emergency spillway is a 200-foot wide grassed channel in the left abutment. The left bank of the spillway is an earth cut, and the right bank is formed by a 7-foot high, 400-foot long training dike. This dike has a top width of 12 feet and side slopes of 3H:1V.

(2) Maximum Known Flood. It is reported in a 1964 watershed study report entitled "Jewell Brook Watershed" that the Jewell Brook Watershed has produced damaging floods in 1927, 1936, 1938, 1952 and 1960. It is stated in the report that the 1938 flood was the most severe of them all, and a recurrence of a flood of this magnitude could cause damages at $870,000 (1964 figures). Industrial, commercial and residential property, and roads and bridges have all received extensive damage from previous floods. In addition, there has been damage to agricultural, industrial and residential property and roads and bridges along the Black River flood plain downstream from the confluence of Jewell Brook.

Since its construction in 1970, the Jewell Brook Site No. 3 Dam has withstood two floods, 1973 and 1976. According to a town official, the 1976 flood was the more severe of the two. There are no written records of maximum pool elevations. Reportedly, the emergency spillway has never discharged flow, but the water surface may have risen to five or six feet below its crest.

(3) Spillway Capacity at Test Flood Elevation. The test flood for the 1.3 square miles is 3,300 cfs inflow. Surcharge storage of 277 acre-feet will attenuate the inflow to a peak outflow of 2,600 cfs at elevation 1246.9 NGVD. The dam will have a freeboard of 4.6 feet when the test flood is routed through the reservoir. The principal spillway will discharge about 140 cfs and the emergency spillway will discharge about 2,460 cfs for a total capacity of 2,600 cfs. The discharge of the principal spillway and the emergency spillway represent 5.4 percent and 94.6 percent of the test flood otflow, respectively.

(4) Spillway Capacity at Top of Dam. When the water is at the top of the dam, elevation 1251.5 NGVD, the principal spillway will discharge 150 cfs and the emergency spillway will discharge 12,300 cfs for a total capacity of 12,450 cfs which is nearly five times as great as the routed test flood outflow.

(5) Total Project Discharge. The total project discharge at the top of the dam is 12,450 cfs with a water surface at elevation 1251.5 NGVD. During the test flood when inflow is 3,300 cfs, the total project will discharge 2,600 cfs at elevation 1246.9 NGVD.

c. Elevation (NGVD)

(1)	Streambed at toe of dam	1186.5
(2)	Bottom of cutoff	1175 (lowest point)
(3)	Maximum tailwater	N/A
(4)	Recreation pool (orifice)	1230.0
(5)	Full flood control pool (principal spillway weir)	1239.7
(6)	Emergency Spillway crest (ungated)	1243.9
(7)	Design surcharge (original design)	1246.7
(8)	Top of dam	1251.5
(9)	Top of dike	1251.5
(10)	Test Flood Surcharge	1246.9

d. Reservoir (Length in feet)

(1)	Normal pool (El. 1230.0)	650
(2)	Flood control pool (El. 1239.7)	850
(3)	Emergency spillway crest pool (El. 1243.9)	1000
(4)	Top of dam (El. 1251.5)	1150
(5)	Test flood pool (El. 1246.9)	1075

e. Storage (acre-feet)

(1)	Normal pool	116
(2)	Flood control pool El. 1239.7	260
(3)	Emergency spillway crest pool (ungated)	335
(4)	Top of dam	492
(5)	Test flood pool	397

f. Reservoir Surface (acres)

(1)	Normal pool	9.0
(2)	Flood-control pool El. 1239.7	14.3
(3)	Emergency spillway crest (ungated)	17.3
(4)	Test flood pool	19.0
(5)	Top of dam	22.1

g.

	Dam	Dike	Dam
(1)	Type	Earth Embankment	Earth Embankment
(2)	Length	325 feet	650 feet
(3)	Height	17 feet	65 feet
(4)	Top Width	12 feet	18 feet
(5)	Side Slopes		
	Upstream	3H:1V	3H:1V
	Downstream	2H:1V	2.5H:1V
(6)	Zoning	None	Upstream shell and central zone composed of the less pervious borrow. Downstream shell composed of the more pervious borrow.
(7)	Impervious Core	None	None.
(8)	Cutoff	Cutoff about 4 feet deep into water, laid deposits in foundation	Cutoff about 6 feet deep into water, laid deposits in foundation
(9)	Groute Curtain	None	None

h. Diversion and Regulating Tunnel

Not applicable

i. Spillways

Low Stage Outlet	
Type	Orifice
Size	1 foot x 1.4 foot
Elevation	1230.0 NGVD
High Stage Outlet	
Type	Two weirs
Size	7.5 feet each
Elevation	1239.7 NGVD
Emergency Spillway	
Type	Grassed Spillway
Size	200-feet wide
Elevation	1243.9 NGVD

j. Regulating Outlets

The only gated outlet is an 18-inch diameter reservoir drain at elevation 1205.9 NGVD. This is operated only to drain the reservoir and is not a part of the usual procedure to regulate pool levels.

SECTION 2

ENGINEERING DATA

2.1 Design Data

Two sources of design information were available. A watershed work plan entitled "Jewell Brook Watershed" published in 1964 provided background information concerning the design of the dam. The purpose of the report was to analyze the needs of Jewell Brook Watershed and to make recommendations based on its findings. The report contains a summary of past flooding damages and performs a benefit-cost comparison to determine the most cost-effective solution for the flooding problem. Construction of four flood control dams in the Jewell Brook Watershed was recommended.

The other source, the Jewell Brook Site No. 3 design notes, provided specific design information. The design data includes information on geology, soils, hydrology, and structural analysis. The folder contained detail calculations and contract drawings and specifications.

2.2 Construction Data

A set of as-built drawings of the original construction of the Jewell Brook Site No. 3 Dam is available. The drawings are detailed and are in good condition. The drawings consist of 23 photostatic reductions. Included in the as-built drawings are four sheets which contain test pit and boring logs for the site.

2.3 Operation Data

There is an operation and maintenance handbook for Jewell Brook Site No. 3 Dam in the Ludlow Town Office. There are procedures for monitoring the structure. The Vermont Department of Water Resources and the Soil Conservation Service perform a joint inspection of the dam annually.

2.4 Evaluation of Data

a. Availability. A copy of the watershed work plan entitled "Jewell Brook Watershed" is available from the Woodstock Soil Conservation District, Woodstock, Vermont 05091. As-built plans and the design report are kept on file by the main office of the Soil Conservation Office. This information is available at the following address: Soil Conservation Service, One Burlington Square, Burlington, Vermont 05401. Copies of annual field inspection reports are also available from that office. A copy of the most recent inspection (May 30, 1979) is included in Appendix B.

b. Adequacy. The availability of in-depth engineering data permitted a review of the original design. Technical data pertaining to the original design of the dam such as materials used such as soils gradation data were readily available. As-built plans and design notes provided detail data for the Phase I inspection.

c. Validity. The as-built drawings and the design data presented in the design folder appear generally accurate even though some minor inconsistencies were detected. For example, the as-built elevation presented on the sheet showing the structural details of the concrete intake structure are not consistent with the measured height of the intake structure. As-built notes indicate a change in the elevation of the footing, but no changes were made to the height dimension of the concrete intake structure or to the top elevation. As a result, the dimensions do not agree.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Jewell Brook Site No. 3 was performed on November 1, 1979. The weather was sunny and fair with temperatures near 58°F. The inspection team included personnel from DuBois & King, Inc., Geotechnical Engineers, Inc., and Knight Consulting Engineers, Inc., accompanied by a representative of the Soil Conservation Service. A copy of the inspection checklist as completed during the field inspection is included as Appendix A. At the time of the inspection, the water level was near the invert of the low-stage orifice (elevation 1230.0 NGVD).

b. Dam. Jewell Brook Site No. 3 is an earth embankment structure consisting of a main dam and a dike across a saddle in the right abutment (Photo 1). The earth structure consists of a zoned, compacted earth fill with a cutoff trench into the foundation. The main dam has a top width of 18 feet and is approximately 650 feet long and 65 feet high (Photo 2). Both the upstream and downstream slopes of the dam are grassed. A 10-foot wide berm is located on the downstream face approximately one-third of the way up from the toe of the dam (Photo 3). A similar berm on the upstream face is below the normal water line. There is a narrow footpath on the upstream face slightly above the water line (visible in the lower right corner of Photo 4); a 10-inch high scarp exists in this zone. It appears that this sloughing is shallow, and it may be caused by frost effects or rapid drawdown. Although the footpath continues past the outlet riser to the right, no scarps were observed on this portion of the slope (Photo 5). The grass cover is excellent but requires mowing to ensure that inspections will reveal any changes that may be occurring with time.

The crest of the dam (Photo 6) is mowed regularly and is in good condition. The downstream face of the dam has a well developed grass cover (Photo 7). Mowing is done only on the flatter portions of the slopes. Annual mowing of the steeper slopes should also be done.

The right abutment is eroded just above the water line (Photo 8). This zone is natural ground that was covered by a relatively impervious blanket during construction. It appears that this blanket material is being eroded away. At the downstream right-abutment contact line, a one- to two-foot deep erosion gully has formed (Photo 11).

Numerous deer trails were found on the upstream and downstream slopes of the dam, but are causing no significant erosion. On the downstream side, some erosion holes of three- to four-inch size were noted passing under the root mat. Annual mowing and inspection are needed so that such erosion holes can be observed and filled as needed to deter further erosion.

The saddle dike on the right side of the dam is in good condition (Photo 9). It has a top width of 12 feet and is approximately 325 feet long and 17 feet high. According to Mr. Carlson of the SCS, the cut-off trench under the dike extends down to glacial till. Several deer trails pass up and down the slopes, but no significant erosion has occurred (Photo 10).

c. Appurtenant Structures. Structures appurtenant to the dam include a principal spillway, an emergency spillway, a reservoir drain and a drainage system under the downstream slope. The principal spillway consists of a two-stage, reinforced concrete intake structure connected to a 30-inch diameter conduit. The emergency spillway is a 200-foot wide grassed channel in the left abutment. A drainage system is located on the downstream portion of the dam.

The intake structure (Photo 12) is in good condition. The concrete shows no signs of cracking or of efflorescence. The condition of the steel trash racks is good. Access to the top of the tower is provided by a makeshift rope ladder in poor condition. Because of the auxiliary recreational use of this structure it is suspected that the rope ladder was installed by persons other than the owners.

The outlet conduit is exposed approximately 25 feet at the discharge end (Photo 13). Minor efflorescence was observed on the cradle which supports the outlet end of the concrete conduit. A hairline crack with efflorescence was detected at the downstream conduit joint but no seepage was evident. The condition of the conduit is generally good (Photo 14).

The emergency spillway (Photo 15) is used as an athletic field for field hockey (Photo 16) and hence the grass is mowed and kept in good condition. There is some concern about the ability of this spillway to withstand the design velocities (see Section 6).

The toe drains are unobstructed and appeared to be functioning (Photos 17 and 18) although some minor seepage was observed downstream from the right drain.

d. Downstream Channel. The downstream channel is a steep, natural channel through a heavily wooded area (Photo 19). The floor of the channel is lined with large rocks. There are no signs of excessive erosion or other deterioration.

e. Reservoir Area. The reservoir shoreline is occupied by a recreation area with a sandy beach (Photo 20). The reservoir is free from overhanging trees and rocks.

3.2 Evaluation

Evaluation of the adequacy of the grass cover on the emergency spillway is necessary and is discussed in Section 6.2.

Maintenance of the wave cut surface on the upstream side of the right abutment and of the shallow sloughs to the left of the intake structure near the water line is required.

Erosion protection should be placed along the downstream half of the right abutment contact line, since a gully is forming there.

Annual mowing of all slopes should be undertaken so that the inspections can be made more easily. The small erosion channels that are forming locally under the root mat on the downstream face should be maintained.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. Jewell Brook Site No. 3 is a dual-purpose dam (flood control and recreation). Its operation is automatic. The water elevation of the pool is regulated by the hydraulic capacity of the two-stage concrete intake structure which serves as the principal spillway. A nine acre recreation pool is maintained by the low stage orifice at elevation 1230.0 NGVD. As inflow increases, the capacity of the low stage inlet is exceeded causing the water surface to rise. When the water surface reaches elevation 1239.7 NGVD, water is discharged over the weirs of the principal spillway. The permanent pool can be lowered by manually opening the reservoir drain. The drain consists of a drain inlet and an 18-inch diameter corrugated metal pipe connected to the service spillway intake structure. Flow into the reservoir drain is controlled by a sluice gate located inside the intake structure. Its hand operated mechanism is located on top of the intake structure. To operate the valve, the operator must climb up the rope ladder attached to the intake structure. During low pool elevations, the operator can get to the intake structure by walking down the upstream face of the dam. During high pool elevations the operator must use a boat to reach the intake structure. An emergency spillway is provided to serve as an emergency overflow during an unusually severe flood. The approximate drawdown time for the 100-year storm is 5.6 days.

The dam provides facilities for various forms of public recreational use such as swimming, fishing, picnicking, camping, boating, ice skating and general relaxation. A small fee is charged for the use of the facilities. The money collected from the fees are used to pay for operation and maintenance.

b. Warning System. There is no system to warn of an impending flood or to warn of possible overtopping. The dam is inspected jointly by the Soil Conservation Service and the Department of Water Resources on an annual basis. Woodstock Soil Conservation District office personnel visually inspect the dam during heavy flows as a safety precaution. Town officials and maintenance personnel periodically make a visual inspection of the dam to check for unusual conditions. No written records are kept of their findings.

4.2 Maintenance Procedures

a. General. There is no schedule for maintaining the dam. Maintenance is performed as needed. The Town Manager hires a local farmer to mow the grass on the slopes of the dam at least once a year. The farmer's mowing equipment is not suited for mowing the steeper slopes of the dam. As a result, the farmer only mows the flatter slopes. The unmowed steep slopes are in an undesirable condition. The tall grass makes it difficult to detect erosion problems such as animal holes, sloughing, and erosion channels at an early stage.

4.3 Evaluation

No significant operational or maintenance deficiencies were found. The dam has required little maintenance since its original construction.

Some minor deficiencies were found. The owner should assure that all slopes are mowed on a routine basis. The slopes should be checked for animal holes and erosion problems while the grass is short.

The owner should remove debris from the low level orifice on the intake structure at intervals of not more than three months.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Jewell Brook Site No. 3 Dam is an earth embankment approximately 650 feet long and 65 feet high. The appurtenant works are a principal spillway and an emergency spillway. The principal spillway consists of a two-stage reinforced concrete intake structure that is connected to a 30-inch diameter conduit. The reservoir drain at the bottom of the intake structure also flows into the 30-inch diameter conduit when opened.

The emergency spillway consists of a 200-foot wide excavation in the left abutment with side slopes of 3H:1V.

The low stage inlet of the reinforced concrete intake structure is a 1-foot by 1.4-foot rectangular orifice at elevation 1230.0 NGVD. The high stage spillway consists of two spillway weirs 7.5 feet long at elevation 1239.7 NGVD. The emergency spillway channel has a crest elevation 1243.9 which is 7.6 feet lower than the crest of the dam.

At the crest of the emergency spillway, the principal spillway will discharge 150 cfs. The emergency spillway can pass approximately 12,300 cfs before the dam is overtopped. The normal water surface is maintained at 1230.0 NGVD, with the majority of the reservoir's storage allocated for flood surcharge storage. The normal pool storage occupies 24 percent of the maximum storage. The entire flood control process is automatic, with no manual operation being needed to regulate the spillways.

The watershed of Jewell Brook Site No. 3 Dam is characterized by steep, heavily wooded slopes. Topographic elevations range from about 153' to 3340 feet. The maximum pool area afforded by the Jewell Brook Site No. 3 Dam represents approximately 2.6 percent of the total drainage area.

5.2 Design

Detailed hydrologic information pertaining to the original design of the dam was obtained from the Soil Conservation Service. This information was prepared by Soil Conservation Service personnel in accordance with procedures as outlined in the National Engineering Handbook of the Soil Conservation Service, Section 4, Supplement A - Hydrology (NEH 4A) and Section 5 - Hydraulics (NEH 5). The information included a watershed analysis, flood routing, discharge frequency analysis and dam design criteria. The dam was tested with three probable storms conditions. The three storms represent a 100-year storm with three different antecedent moisture conditions. The dam was designed with a two-stage principal spillway. The low-stage release rate was set as low as practical while staying within a six-day drawdown time. The high-stage outlet was sized to use the full capacity of the pipe. Storage in the low stage was set to delay the operation of the second stage during the passage of a 6-hour, 100-year storm so that its outflow would lag the peak from the uncontrolled area within the watershed for at least two hours. The information was reviewed and found to be in accordance with commonly accepted engineering practice.

5.3 Experience Data

The Jewell Brook watershed has produced several damaging floods in past years. The major floods of record occurred in 1927, 1936, 1952, and 1960. Nearly every spring there was a potential flood danger from rapidly melting snow augmented by rainfall. The flood of September 1938 was the most damaging flood on Jewell Brook. The June 1960 flood, although not as large as the 1938 flood, did cause extensive damage on Jewell Brook and was the last flood of that magnitude prior to construction of the dam.

Jewell Brook Site No. 3 dam is one of four flood retarding structures that were constructed to control runoff, from the Jewell Brook watershed upstream of Ludlow. Together they control 75 percent of the Jewell Brook drainage area. Since construction (1968 through 1972), these structures have attenuated all floods without spilling water over their respective emergency spillways. However, the 1973 and 1976 floods reportedly exceeded the level of the upper stage of the principal spillway; the 1976 event reportedly rose to within five feet of the emergency spillway crest. The dams have helped alleviate flooding in the Village of Ludlow due to runoff from the Jewell Brook watershed.

5.4 Test Flood Analysis

The 65-foot height of this structure places it in the Intermediate class, that range being greater than 40 feet and less than 100 feet. The hazard classification is High, based upon the close proximity of the Village of Ludlow and the location of many dwellings in the path of flooding from a potential dam break. In accordance with "Recommended Guidelines for Safety Inspection of Dams," the test flood is the Probable Maximum Flood (PMF). The PMF curve envelope for Mountainous Areas was used to obtain a unit discharge per square mile value for the appropriate drainage area. This unit discharge was then multiplied by the drainage area of 1.3 square miles to obtain the PMF inflow of 3,300 cfs. This test flood inflow was routed through the reservoir assuming the water surface to be initially at conservation pool (elevation 1229.7 NGVD). The structure can pass the full PMF without being overtopped. The resulting surcharge storage would attenuate the test flood inflow to 2,600 cfs outflow and result in a freeboard of 4.6 feet. Velocities at the control section of the emergency spillway would be about 7.8 fps. The routed test flood outflow of 2,600 cfs represents a reduction of 21 percent of the test flood inflow.

5.5 Dam Failure Analysis.

A hydraulic analysis for dam failure under test flood conditions was performed for the main dam and the saddle dike. Prior to failure, the water level would be 1246.9 NGVD and the structure would be spilling 2,600 cfs. The breach height (water surface to upstream toe) would be 41.1 feet and 12.9 feet for the main dam and the saddle dike respectively.

Since this dam impounds a relatively short reservoir, it was judged that a breach width of 10 percent of the dam width would represent a reasonable estimate for dam failure analysis for the main embankment. Thus, a breach width of 65 feet, and a depth of water of 41.1 feet were used in the Saint-Venant equation to compute a breach outflow for the main embankment of 28,800 cfs over and above the 2,460 cfs discharged by the structure during the test flood. The breach of the main embankment would produce a wave 11.0 feet higher than the test flood level in Jewell Brook. The resultant stage would be 15.0 feet at

the confluence of Jewell Brook and Parker Brook, which is 0.3 miles downstream of the structure. This is expected to inundate approximately 20 houses producing water levels about five feet above the first floor levels in some instances. It is considered that this would endanger the lives of more than a few people. By the time it reached the populated area of the village, the flood wave would be 7.0 feet high and the stage would be 9.2 feet above streambed. Here again, more than a few lives would be endangered.

A breach failure analysis was performed for the saddle dike assuming a breach width of 10 percent (32.5 feet) of its width. The breach would produce an instantaneous discharge of 2,500 cfs and would result in a 4.4-foot flood wave in the gully located downstream. It is expected that this 4.4-foot flood wave would not cause appreciable damage to any dwelling downstream with flood levels approximately level with the first floor of one dwelling. It is expected that the energy of this flood wave would be almost total dissipated by the time it reached an open field located approximately one quarter mile downstream.

A failure of the main dam is likely to endanger more than a few lives and therefore, the dam is classified as High hazard. Failure of the dike is not expected to endanger lives, therefore, it is considered to be a Low hazard structure.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

Based on visual observations alone, this dam appears to be in good structural condition. The only item noted that ultimately may be related to structural stability is the wave-cutting of the blanket material that covers the upstream side of the right abutment. If the blanket material is penetrated due to erosion, then its effect in reducing gradients through the abutment would be impaired.

6.2 Design and Construction Data

The emergency spillway channel is grass and is cut into water-laid deposits of the left abutment. The spillway is designed to accommodate a 100-year storm, which would cause a velocity of 7.8 fps for about five hours according to the Soil Conservation Service design report. The emergency spillway has not been used to date, based on available information.

The design of the emergency spillway channel should be checked to determine whether or not the cover should be improved. The Soil Conservation Service has modified its guidelines pertaining to the design of earth spillways since the construction of this dam. Since the dam will impound large volumes of water during storms, rapid erosion of the spillway at those times could impose a greater danger downstream than would exist in the absence of the dam. Due to the potential erosion of the spillway this dam is judged to be in fair condition.

The dike that forms the right training wall for the emergency spillway is a grassed, earth dike composed of non-plastic soils. This dike is also susceptible to erosion under the velocities that would be imposed during the test flood. Erosion of the dike would allow the spillway to discharge onto the toe of the main dam. Therefore, the suitability of this dike should be determined when the spillway is evaluated.

According to Mr. Carlson of the SCS, who was present during construction, the entire main dam was excavated to bedrock. At the left and right abutments the excavation for the cutoff was carried to glacial till.

6.3 Post-Construction Changes

Jewell Brook Site No. 3 has not undergone any construction modifications since its original construciton.

6.4 Seismic Stability

This Dam is in Seismic Zone 2. Therefore, according to the Corps of Engineers recommended guidelines, a seismic stability analysis is not warranted.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the visual inspection, the dam is in good condition. However, because of the potential for erosion of the emergency spillways, the overall condition is judged to be fair.

b. Adequacy of Information. This Phase I inspection report was based on visual inspection, on previous inspection reports by the Vermont Department of Water Resources and Soil Conservation Service personnel, on design drawings and specifications, and on Soil Conservation Service design notes.

c. Urgency. The recommendations presented in Sections 7.2 and 7.3 should be carried out within one year from receipt of this report by the owner.

7.2 Recommendations

A registered engineer qualified in the design and construction of earth dams should be engaged to review the design of the erosion protection of the emergency spillway and its right training dike. Current standards published by the Soil Conservation Service and other agencies should be applied and the appropriate design storm used. Recommendations should be made by the engineer and implemented by the owner.

7.3 Remedial Measures

a. Operation and Maintenance Procedures. The owner should implement a systematic maintenance program consisting of the following items:

1. All slopes of the dam should be mowed annually, including the steeper ones.

2. Repair the shallow sloughs on upstream slope and the wave cut on upstream side of the right abutment. These areas should be observed on an annual basis to detect any future problems.

3. Place filtered erosion-control material in the gully that has formed on downstream half of the downstream right abutment contact line.

4. Annually inspect and repair minor erosion that has occurred under root mat of grass cover.

5. The outflow from the downstream drain should be observed periodically so that any changes in seepage conditions will be detected. Also, monitor downstream slopes and abutments, preferably during or just after periods of high reservior level.

6. Remove rope ladder and use a portable ladder for access to the control tower of the intake structure.

7. Remove debris from the low level intake of the intake structure.

8. Establish written procedures for operating and maintaining the dam. The written procedures should include a formal downstream warning system and a plan for surveillance.

9. Operate drain valve annually to assure operability.

10. Continue annual technical inspections.

7.4 Alternatives

None.

APPENDIX A

VISUAL CHECKLIST WITH COMMENTS

INSPECTION CHECKLIST

PARTY ORGANIZATION

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

TIME 1400

WEATHER Sunny, 58°F

W.S. ELEV. _____ U.S. ___ DN.S.

PARTY:

1. John Bilotta D&K
2. John Somaini, D&K
3. Steve Poulos, GEI
4. Elroy Langell, KCE
5. Paul Carlson, SCS
6. _____
7. _____
8. _____
9. _____
10. _____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Earth Dam	S. Poulos	
2.	Concrete & Appurtenences	E. Langdell	
3.	Hydrology/Electro-Mech.	J. Bilotta	
4.			
5.			
6.			
7.			
8.			
9.			
10			

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

PROJECT FEATURE

NAME E.L. Langdell

DISCIPLINE

NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	(Zero station at left abutment intersection with centerline of training dike.
Crest Elevation	1251.5 NGVD
Current Pool Elevation	1229.7 NGVD
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed.
Pavement Condition	None, grassed on crest.
Movement or Settlement of Crest	None observed.
Lateral Movement	None observed.
Vertical Alignment	OK.
Horizontal Alignment	OK.
Condition at Abutment and at Concrete Structures	Upstream Right - Erosion (wave cut) at shoreline of blanket material to 100' right of contact line. Downstream Right - 1-2' deep erosion gully at contact. Downstream Left - Good. Heavily grassed. Minor gully. Upstream Left - Good condition. Heavily grassed.
Indications of Movement of Structural Items on Slopes	Outlet Structure - None. Intake Structure - None.
Trespassing on Slopes	Free access. Deer trails. A few 3-4" deep erosion channels under root mat. Grass waist high. Difficult to see animal holes, if any. None observed.
Sloughing or Erosion of Slopes or Abutments	One slough (about 10" deep at shoreline Sta 1+50R. See photos. Also, shoreline is irregular, like wave cutting or minor frost sloughs.
Rock Slope Protection-Riprap Failure	None.
Unusual Movement or Cracking at or Near Toe.	None observed.
Unusual Embankment or Downstream Seepage	Ground damp to right of right toe drain.

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

PROJECT FEATURE

NAME E.L. Langdell

DISCIPLINE

NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT (Continued)	
Piping or Boils	None observed.
Foundation Drainage Features	None.
Toe Drains	Left toe drain running at approx. 4 gpm. Right toe drain dry. See plans.
Instrumentation System	None.
Vegetation	Waist-high grass. Not mowed on slopes. Mowed on crest and downstream berm.

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 2 DATE November 1, 1979

PROJECT FEATURE NAME E.L. Langdell

DISCIPLINE NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
DIKE EMBANKMENT	
Crest Elevation	1251.5 NGVD
Current Pool Elevation	1229.7 NGVD
Maximum Impoundment to Date	Not known.
Surface Cracks	None observed.
Pavement Condition	None.
Movement or Settlement of Crest	None observed.
Lateral Movement	None observed.
Vertical Alignment	Looks straight.
Horizontal Alignment	Looks straight.
Condition at Abutments	Good condition. Heavy grass.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	Free access. No erosion or other signs of wear observed. Deer trails.
Sloughing or Erosion of Slopes or Abutments	None observed. A few 2-4" deep erosion gullies under root mat, concentrated near center of dike.
Rock Slope Protection - Riprap Failures	N.A.
Unusual Movement or Cracking at or Near Toes	None observed.
Unusual Embankment or Downstream	None observed. Pool only 2 ft. to 5 ft. above downstream toe of dike.
Piping or Boils	None observed.
Foundation Drainage Features	None.
Toe Drains	None.
Instrumentation System	None.
Vegetation	Waist-high grass. Well-matted.

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

PROJECT FEATURE

NAME E.L. Langdell

DISCIPLINE

NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Grassed on left, forested on right.
Bottom Conditions	Below pond.
Rock Slides or Falls	None.
Log Boom	None.
Debris	None observable.
Condition of Concrete Lining	N.A.
Drains or Weep Holes	N.A.
b. Intake Structure	Refer to next page - Outlet Works- Control Tower
Condition of Concrete	
Stop Logs and Slots	

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

PROJECT FEATURE

NAME E.L. Langdell

DISCIPLINE

NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good.
Condition of Joints	OK.
Spalling	None observed.
Visible Reinforcing	None visible.
Rusting or Staining of Concrete	None.
Any Seepage or Efflorescence	None.
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None observable
Cracks	None
Rusting or Corrosion of Steel	None observable Steel ladder to top of control tower is missing. Makeshift rope ladder is nearly rotted off.
b. Mechanical and Electrical	
Air Vents	N.A
Float Wells	N.A.
Crane Hoist	None
Elevator	None.
Hydraulic System	N.A.
Service Gates	Not observable - wheel or crank for operating gate lifting device was stored.
Emergency Gates	None
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System	None

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

PROJECT FEATURE

NAME E.L. Langdell

DISCIPLINE

NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANISITON AND CONDUIT	Not observable.
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

PROJECT FEATURE

NAME E.L. Langdell

DISCIPLINE

NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition	Good.
Rust or Staining	None
Spalling	None
Erosion or Cavitation	None
Visible Reinforcing	None
Any Seepage or Efflorescence	Efflorescence on cradle under conduit - no seepage
Condition at Joints	Hairline crack with efflorescence at at downstream conduit joint.
Drain holes	N.A.
Channel	
Loose Rock or Trees Overhanging Channel	Many trees (forest) closely overhanging steep channel. Large loose rocks in channel. Not significant relative to possible outflow through conduit.
Condition of Discharge Channel	Good.

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3

DATE November 1, 1979

PROJECT FEATURE

NAME E.L. Langdell

DISCIPLINE

NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Excellent
Loose Rock Overhangin Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	Smooth - grassed.
b. Weir and Training Walls	
General Condition of Slopes	Waist-high grass. Good, 0.6 ft variation in elevation along weir crest
Rust or Staining	N.A.
Spalling	N.A
Any Visible Reinforcing	N.A.
Any Seepage	None observed.
Drains	None
c. Discharge Channel	
General Condition	Good.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Channel	Grassed.
Other Obstructions	None.

INSPECTION CHECKLIST

PROJECT Jewell Brook Site No. 3 DATE November 1, 1979

PROJECT FEATURE NAME E.L. Langdell

DISCIPLINE NAME J.J. Bilotta

NAME S.J. Poulos

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	No Service Bridge
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Underside of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

ENGINEERING DATA

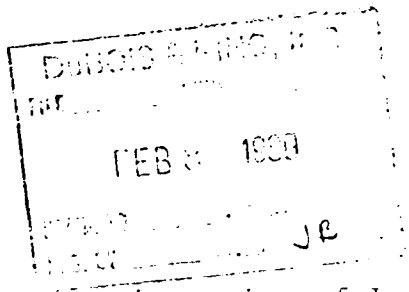
APPENDIX B

ENGINEERING DATA

Description	Location
1. Design Records - Jewell Brook Site No. 3 Dam	
A. Soil Conservation Service Folder	Soil Conservation Service 1 Burlington Square Suite 205 Burlington, Vermont 05401
B. Watershed work plan entitled "Jewell Brook Watershed", 1964.	Woodstock Soil Conservation District Woodstock, Vermont 05091
2. Past Inspection Reports	
A. List of Past Inspections	Appendix B, pg. B-2
B. Inspection Report Dated May 29 & 30, 1979	Appendix B, pgs. B-3 to B-10
C. "O&M Inspection Report" performed on 5/30/79	Appendix B, pgs. B-11 to B-12
D. Other inspection reports	Soil Conservation Service 1 Burlington Square Suite 205 Burlington, Vermont 05401
3. Plans	
A. Plan View - Jewell Brook Site No. 3	Figure B-1 pg. B-13
B. Section of Dam	Figure B-2, pg. B-14
C. Other As-Built Plans	Soil Conservation Service 1 Burlington Square Suite 205 Burlington, Vermont 05401

United States Department of Agriculture
Soil Conservation Service
One Burlington Square
Suite 205
Burlington, Vermont 05401

February 7, 1980



Mr. Don Morin
Dubois & King, Inc.
Randolph, VT 05060

Dear Don:

The dates of the annual operation and maintenance inspections of Jewell Brook Watershed are as follows:

1969 - May 20
1970 - May 26
1971 - June 2
1972 - August 9
1973
1974 - October 3
1975 - June 16
1976 - June 15
1977 - June 9
1978
1979 - May 30 and July 19

I couldn't locate the reports for 1973 and 1978. I know that the inspections were held. I inspected the sites immediately after the 1973 flood.

If I can be of any further assistance, give me a call.

Sincerely,

Paul Carlson
Civil Engineer

State of Vermont
Agency of Environmental Conservation
Department of Water Resources
Montpelier, VT 05602

DAM INSPECTION REPORT

Name Jaquith Brook (Site 3) DWR No. 117-3

Town Ludlow NDS No. VT00 016

Owner Town of Ludlow Inspection Date 5-24-79 → 5-30-79

Address c/o Town Manager's office Ludlow, VT Last Inspected 1976 (SCS)

Telephone 228-7061 Hazard Class 1

Dean R. Brown, Jr. - Town Mgr. Size Category

PERSONS PRESENT AT INSPECTION (Name and Organization):

Inspecting Party A. P. Barking, Jr. - Dept of Water Resources

Paul Garrow - SCS, Burlington

Others NONE

I. General Conditions at Time of Inspection

Weather CLOUDY - LIGHT RAIN - SSW 5/30/79 Overall Condition GOOD

Water Surface Elevation - 50' @ 1620 5/29/79 Lvl on TOP OF RISER

Accessibility ACCESSIBLE - RISER ACCESSIBLE BY LADDER (WENT OUT TO RISER BY RAFT ON 5/29/79).

Reservoir Area GRASS UP TO EDGE OF POND

Remarks 5/29/79 1600. TRIED TO OPEN DRAIN. CLOG ONLY 4-5 TURNS ON CRANK - BOARD UP TOWN BRIDGE AND PET DAM.

DAM INSPECTED ON 5/30/79

II. Condition of Main Structure

Type of Construction EF

A. Upstream Face or Slope

1. Vegetative Cover GOOD GRASS COVER

2. Erosion NONE

3. Slumps, Slides, Cracks NONE OBSERVED

4. Animal Burrows NONE OBSERVED

5. Slope Protection NONE

6. Debris NONE

7. Monuments STABLE, FIRM

8. Alignment OK

9. Alignment OK

10. Movement NONE APPARENT

11. Remarks NO SCOUR SEEN

B. Downstream Face or Fill and Toe

1. Vegetative Cover GOOD GRASS COVER

2. Erosion NONE OF ANY SIGNIFICANCE

3. Slumps, Slips, Cracks NONE OBSERVED

4. Animal Burrows NONE OBSERVED

5. Slope Protection NONE

6. Debris NONE

7. Seepage SLOPE TOO WET TO TELL, NO OBVIOUS SEEPAGE

8. Piping NONE OBSERVED

9. Boils NONE OBSERVED

10. Toe Drain/Channel CHANNEL - SOME FLOW

11. Scour NONE

12. Structural STABLE

13. Abutments OK

14. Alignment OK

15. Movement NONE APPARENT

16. Remarks ROAD CONDITION — SHOULD BE REINSPECTED WHEN SNOW DOES OFF

C. On Ice

1. Visible ice cover SOME SNOW COVER

2. Erosion NONE

3. Evidence of frost heave NONE

4. Depth of ice, if any NONE OBSERVED

5. Surface type of NONE OBSERVED

6. [illegible] NONE

7. Use of area (road, trail, etc.) WHEEL TRACKS - LIGHT DAMAGE

8. Drainage STABLE

9. Alignment OK

10. All runways OK

11. Remarks Case Control

III. Condition of Outlet Works

A. Principal Spillway

Type CORE PIPE

Controlled or Uncontrolled UNCONTROLLED

1. Approach Channel NONE

2. Condition NONE

3. Control Features NOT VISIBLE

4. Discharge Channel CLEAR

5. Is discharge free of debris or trash? YES

6. Condition of Weir - NOT INSPECTED (Concrete Rings and Level)

7. Outlet Conduits Approx. 30' of CMP connected on core, conduit in good condition, Brush should be cut

8. Type of Gate O/C

9. Operation of Gate NONE

10. [illegible], Plan boundary NONE

11. [illegible] WHAT IS USABLE IS IN GOOD CONDITION

B. [illegible]

[illegible] USE STATUS AND CUT

[illegible] MANAGEMENT

1. [illegible] CABLE AND CHAIN SAWS — AXE — MACHETE — ROAD GRADER (BLADE) — SCOOP SHOVEL (BLADE) — STRAP WRENCH

2. [illegible] AS NEED ARISE (WITH AN OKAY FROM CHIEF) — ROAD CUT SHOULD BE GOOD ENOUGH

3. [illegible] MAY BE NEEDED

4. [illegible] MAY NEED

5. [illegible] CHAIN OF CUSTODY

C. [illegible]

CRONIC OPERATOR

1. [illegible] CUT DOWN BY BOTTOM MOST BRANCH

[illegible] 5'3-2" CLEARANCE ABOVE CUT — CLEAR OF

Note: TREE CONTRACTOR CUT TREE WHILE TO DOING FOR ROAD CLEARING. DON'T KNOW HOW FAR THEY GOT IT OPEN. THEY NEEDED CLEARANCE IN ORDER TO.

2. Other Notes, Drains, Appurtenances NONE

Condition

3. Remarks 10" MAIN CAVE / LOCATION NEEDS TO BE EXPOSED

IV. Operation and Maintenance

ROAD IS DEAD END CUL-DE-SAC WITH PAVED ROUND CURVE AND GRAVEL SHOULDER

MAINTENANCE : GOOD

V. Inspector's Opinion:

A. Information Needed:

1. Thoroughness ✓

2. Materials

3. Other

B. Additional Work Needed

(1) W/S SHALL TO BE EXPOSED WHEN ONLY

(2) CAVITY IN 10" ENCASED LINE CLOSE TO MH

C. Other Work Needed

GOOD

SCALE OF CRITERIA AND LIST OF RECOMMENDATIONS AND ANNUAL SYSTEM ACTIVITY MAINTENANCE REQUIREMENTS AND TRAINING BY TAILORED FIELD DUTY MANUAL TO BE A BASIS.

Written by A. Peter Barrowclough PE — Title: Area Safety Engineer

Attachments:
Photos when developed.

5/24/99 1030 Meeting in Bill Brew's Office: Bill Brew, Bill Talbert (SCE), Paul Carlson, BBS to discuss preliminary findings of inspection
① Site 3 had not been inspected before meeting
② Metal problem with pole operator. Tour will occur when pool can be drained down (after rec season is over).
③ All will resigned when results provided.

Copy to Site Staff
Done

JEWELL BROOK WATERSHED
Site No. 3, Recreation Area

Date of Inspection 5/20/79 ORSI INSPECTION RECORD

CHECK LIST

S*	U*	
X		1. Access Gate
		a. Paint
X		b. Operation
X		2. Access Road
		a. Erosion, potholes
X		b. Ditches
X		3. Vegetation
		a. Need for mowing
X		b. Need for fertilizing
		c. Need for reseeding
X		4. Entrance Booth
		a. Exterior paint/stain
X		b. Interior Paint
		c. Electrical
X		5. Bathhouse
		a. Exterior paint/stain
X		b. Interior paint
		c. Electrical
X		d. Plumbing
		e. Floors, ramps, slabs
X		f. Roof, vents
		g. Drain outlet
X		6. Sewage Lift Station
X		7. Building Foundation
X		8. Footpaths
		9. Parking Lot
X		a. Ruts, holes, potholes
X		b. Curb stops
X		10. Beach
		a. Debris, sediment
X		b. Erosion

S	U	
X		11. Picnic Shelter
		a. Roof
X		b. Frame
X		c. Crushed stone base
X		12. Slope Drainage
		a. Diversion
	X	b. Tile Outlet
X		13. Playground Equipment
X		14. Service Road
		a. Erosion, Potholes
X		b. Ditches
X		15. Footbridges
X		16. Chemical Toilet
	X	a. Paint/stain
		b. Roof/vent
X		c. Interior

*S = Satisfactory U = Unsatisfactory

Remarks: (Explain unsatisfactory items above and any other items needing maintenance or repair)

U. S. Department of Agriculture
Soil Conservation Service
Vermont

OPERATION AND MAINTENANCE
AGREEMENT FOR INSPECTION RECORD

Project Jewell Brook Inspection Date 5/20/79

Structure Rec Area Type

Type of Inspection: Annual [X]

Special [ ]

Sponsoring Local Organization Town of Ludlow

Present for Inspection Paul Carlson, SCS

Pete Barrasso, VT Dept. of Water Resources

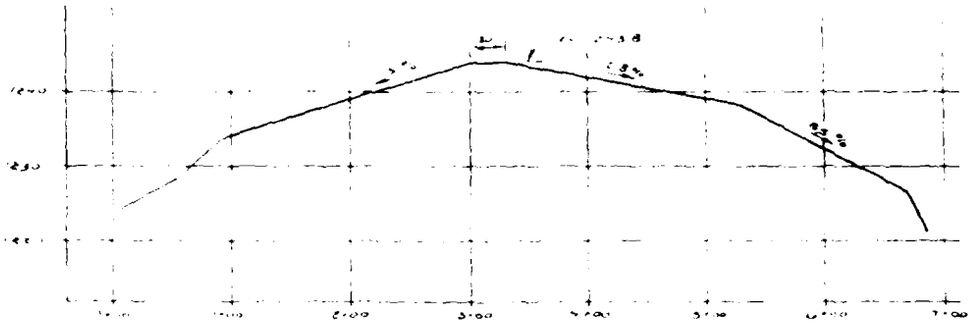
Item	Maintenance & Needed Repairs	Estimated Costs	Agreed Date Repairs to be Completed
12.6.	Ins. small animal guard at inlet and outlet	$20	
11.6.	Repl. vent pipe on chemical toilet	$20	

REMARKS:

SCS Representative

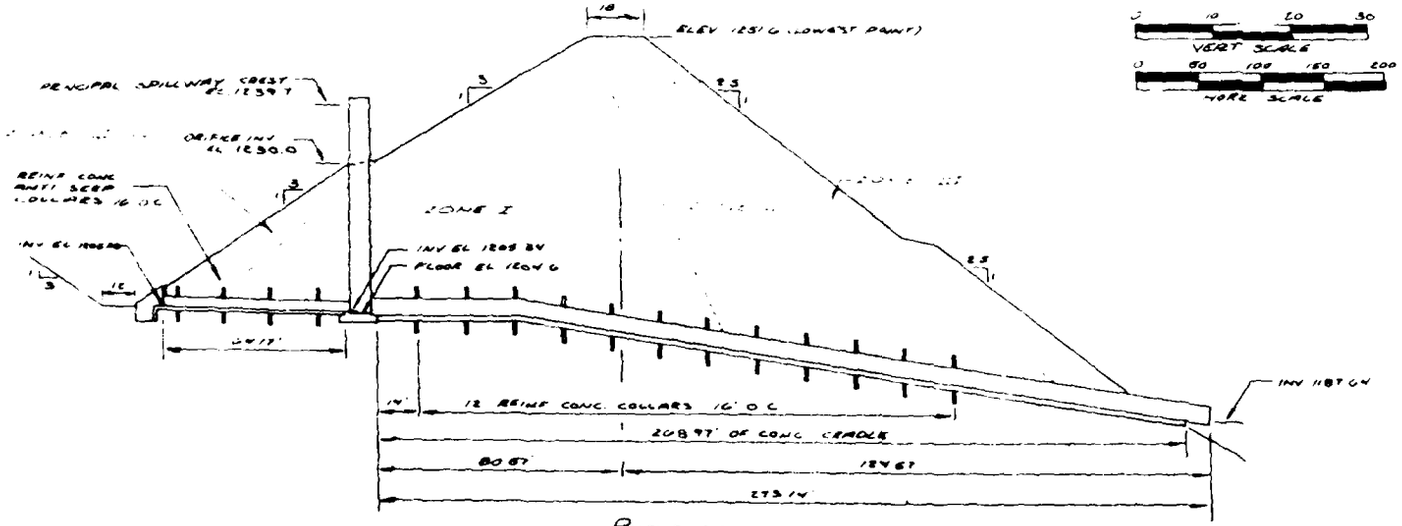
SLO Representative

Distribution: Dd, SLO, State Office



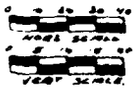
PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

SECTION B-B



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

SECTION A-A



EARTH EMBANKMENT	
ZONE	MATERIAL
I	SILTY SAND
II	SILTY SAND
III	AS RE MAKED FROM ZONE I & II

TRACED FROM DRAWING PREPARED BY
USDA SOIL CONSERVATION SERVICE 1967

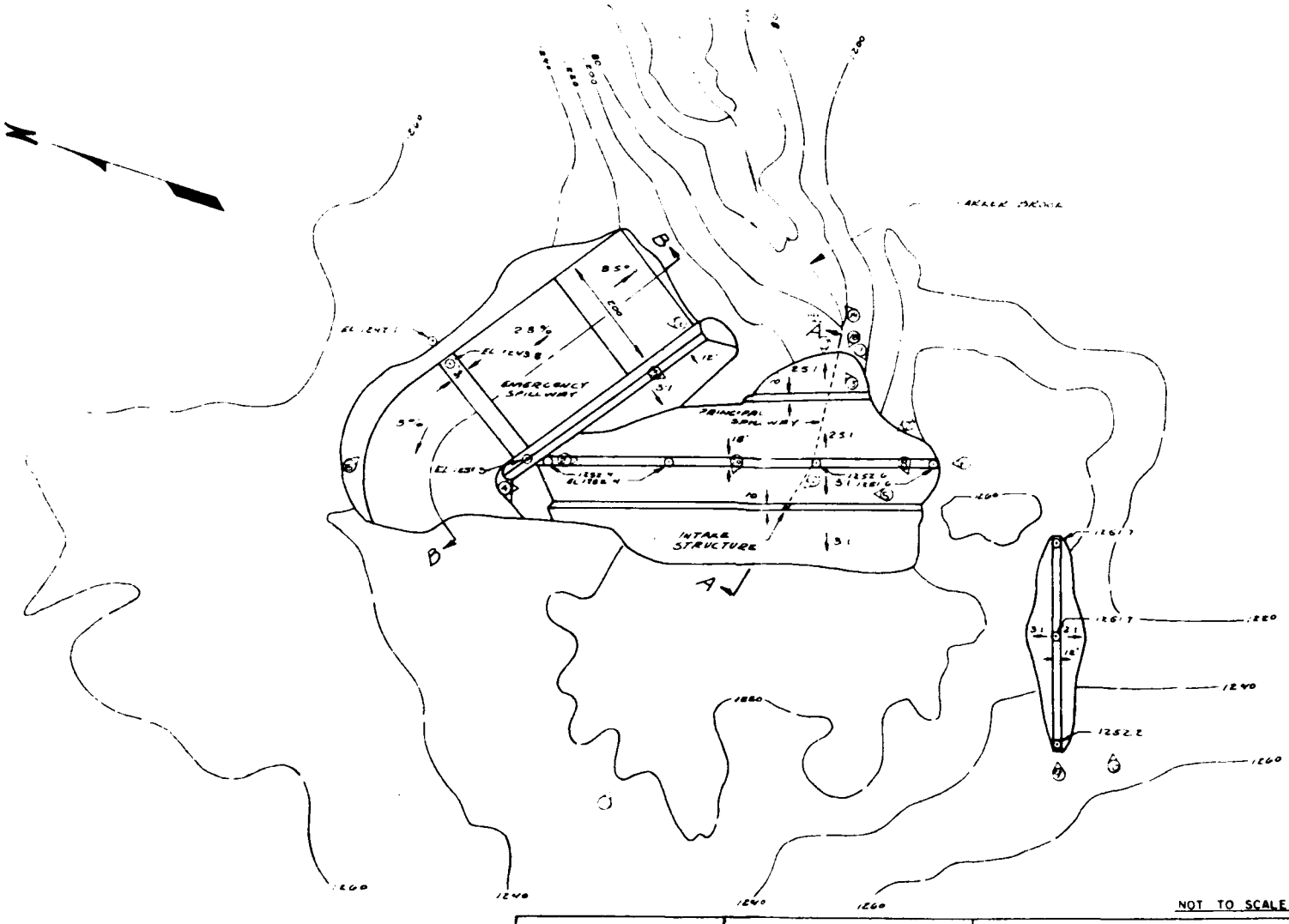
DuBois & King Inc.

Department of the Army
New England Division
Corps of Engineers
Waltham, MA 02154

National Dam Inspection Program
Jewell Brook Watershed
Dam Site No. 3
Ludlow, Vermont
Plan and Section Views

JAS	2/80
	9/13

B-2



LEGEND

- POINT ELEVATION
- DIRECTION OF PHOTOGRAPHS

NOT TO SCALE

TRACED FROM DRAWING PREPARED BY
USDA SOIL CONSERVATION SERVICE 1967

DuBois & King Inc.

Department of the Army
New England Division
Corps of Engineers
Waltham, MA 02154

National Dam Inspection Program
Jewell Brook Watershed
Dam Site No. 3
Ludlow, Vermont
General Plan

JAS	2/80
TMC	9/83

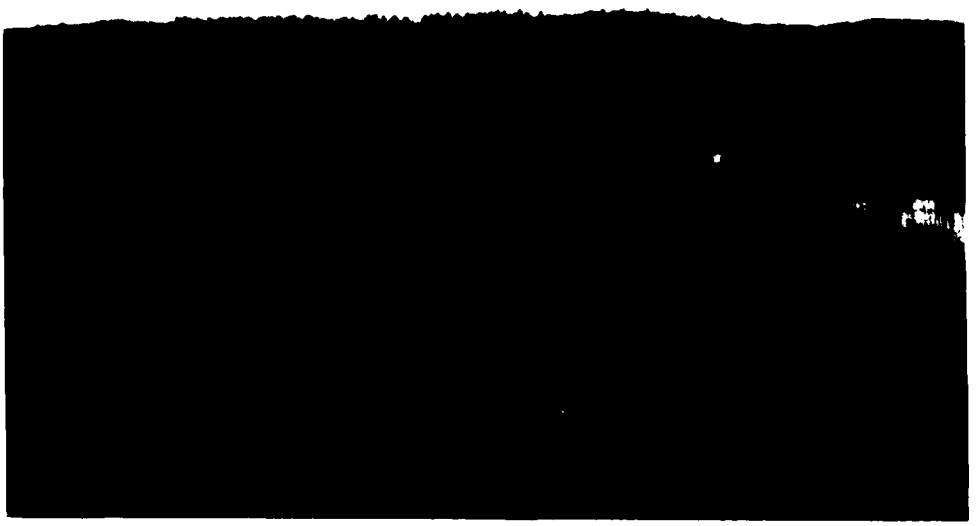
B-1

APPENDIX C

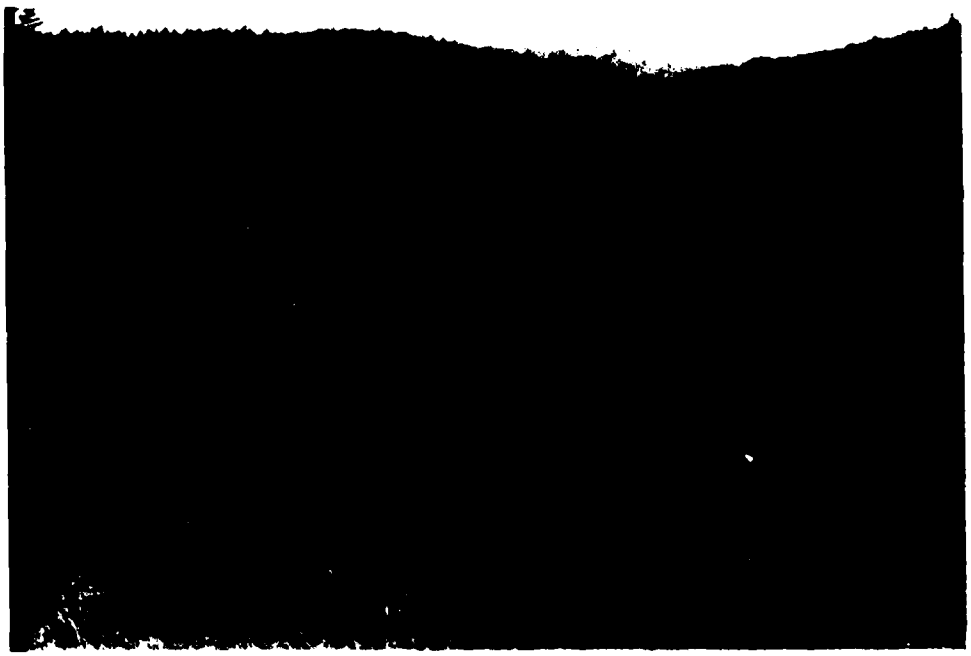
PHOTOGRAPHS

FOR LOCATION OF PHOTOS, SEE FIGURE B-1
LOCATED IN APPENDIX B

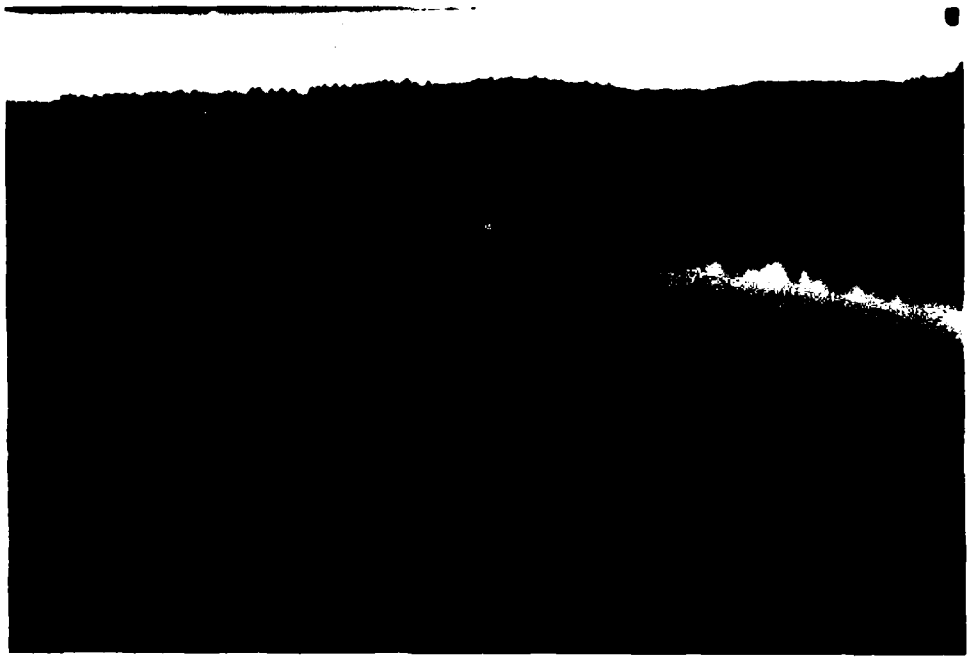
#1 UPSTREAM FACE OF DAM AND DIKE



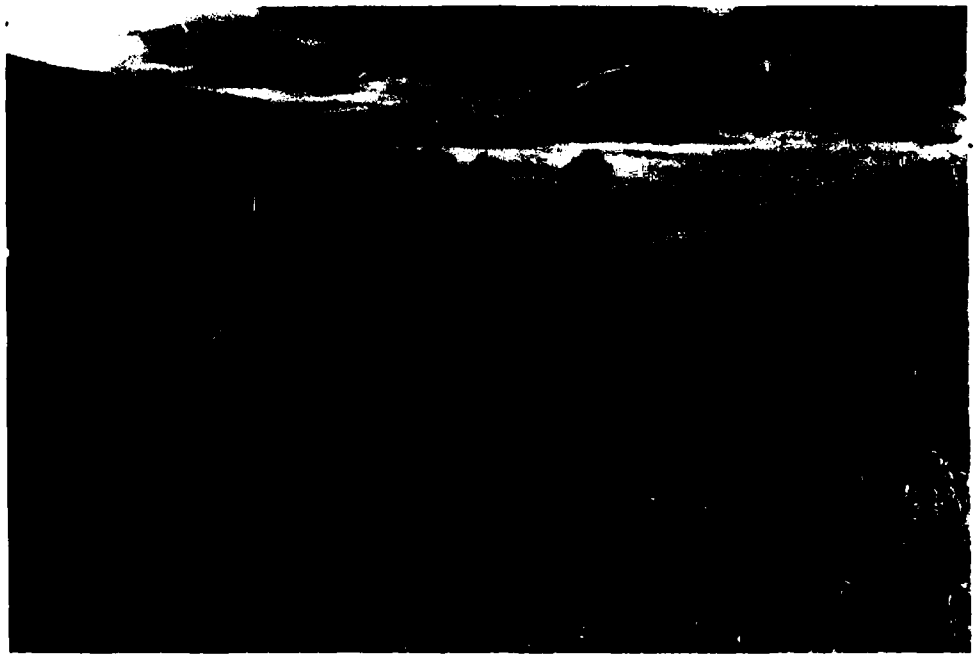
#2 CREST OF DAM FROM LEFT ABUTMENT



#3 DOWNSTREAM FACE FROM LEFT ABUTMENT



#4 UPSTREAM FACE FROM LEFT ABUTMENT



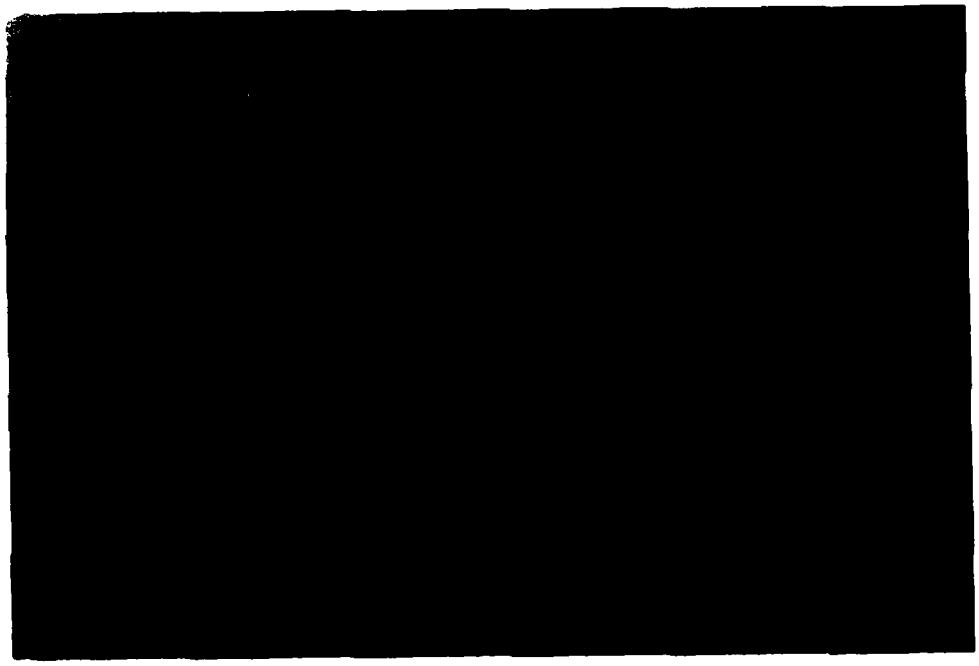
#5 UPSTREAM FACE FROM RIGHT ABUTMENT

#6 CREST OF DAM FROM RIGHT ABUTMENT

#7 DOWNSTREAM FACE FROM RIGHT ABUTMENT

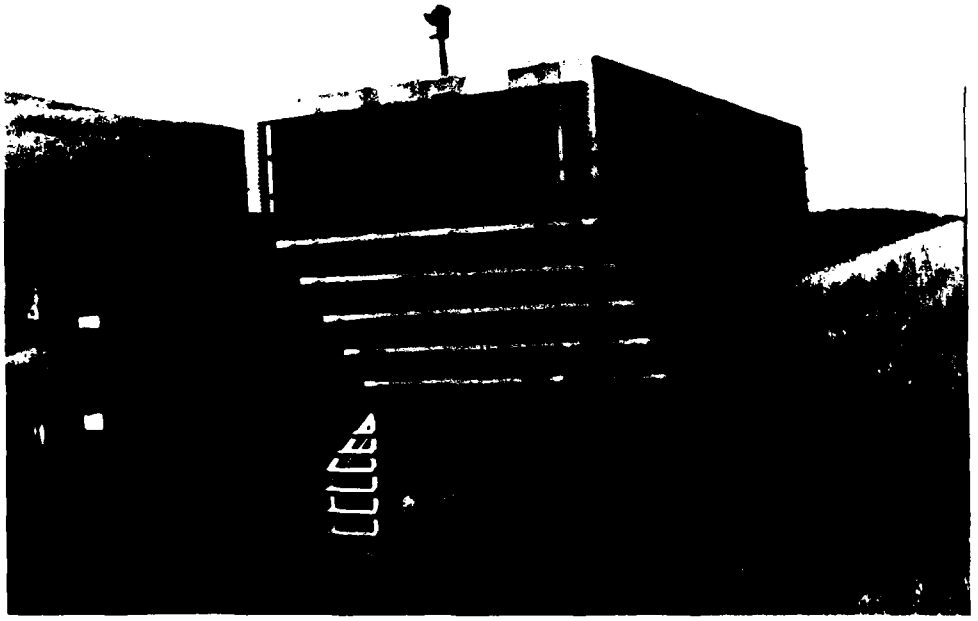
#8 RIGHT ABUTMENT UPSTREAM OF CREST

#9 DIKE UPSTREAM OF RIGHT ABUTMENT



#10 DOWNSTREAM FACE OF DIKE

#11 EROSION ALONG DOWNSTREAM
RIGHT ABUTMENT CONTACT LINE

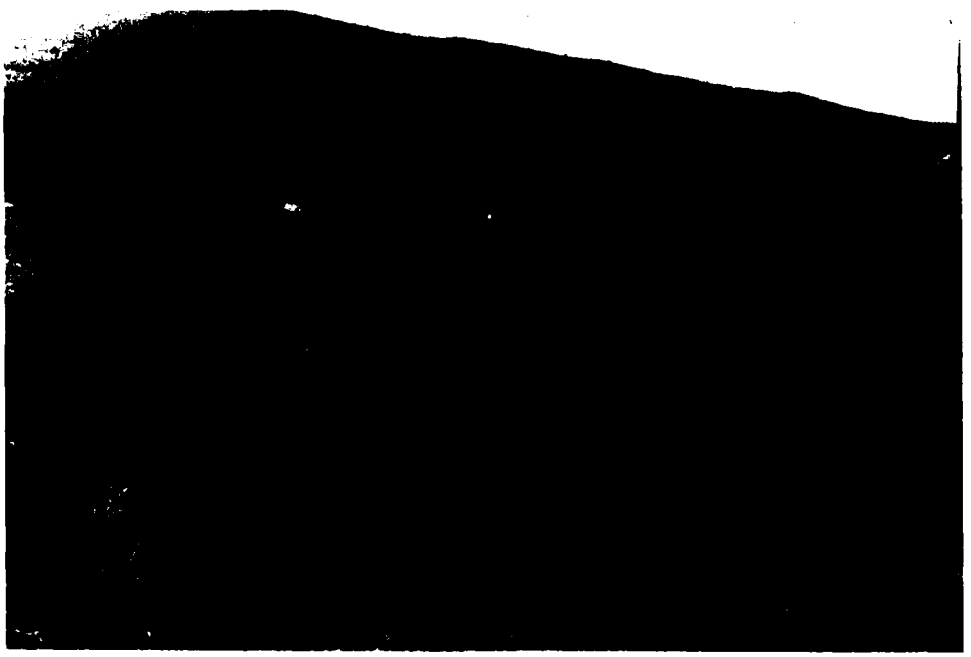


#12 PRINCIPAL SPILLWAY RISER

#13 OUTLET CONDUIT

#14 DISCHARGE OF OUTLET CONDUIT

#15 EMERGENCY SPILLWAY LOOKING DOWNSTREAM

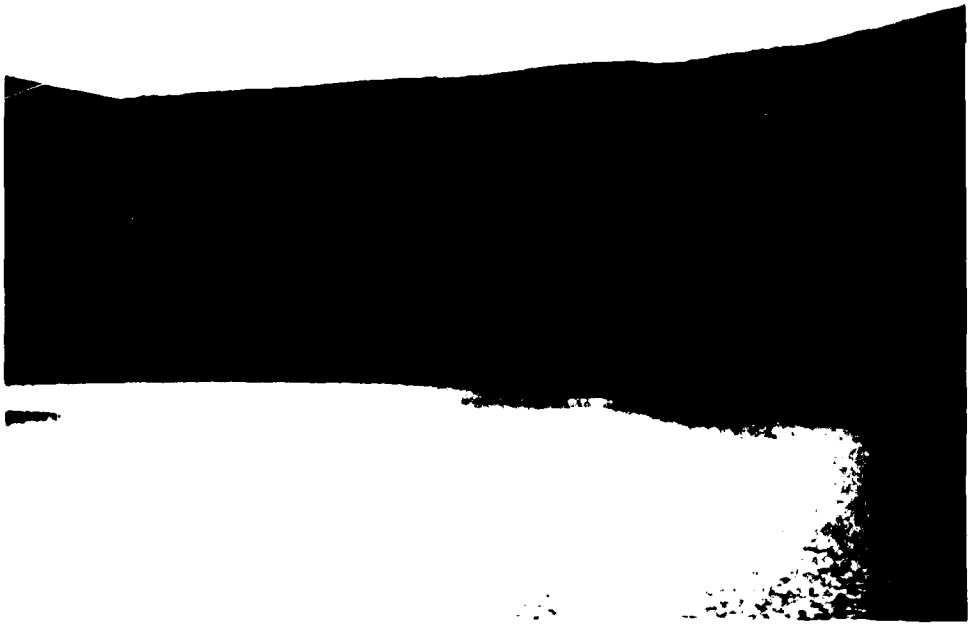


#16 EMERGENCY SPILLWAY LOOKING UPSTREAM

#17 LEFT TOE DRAIN OUTFALL

#18 RIGHT TOE DRAIN OUTFALL

#19 DISCHARGE CHANNEL LOOKING DOWNSTREAM



#20 RESERVOIR AREA FROM DAM CREST

APPENDIX D

PLUTONIC AND HYDRAULIC CALCULATIONS

Job No. 7113 Sheet 1 of 20
Project [illegible] Date 8/21/87
Subject [illegible] By [illegible] Ch'k. by

CN's values checked for validity

Drainage Area: DA acres = 1.3 mi² OK

Pen, grams to Evaporation curves: CN's values

[illegible] (Refer to pages 2-1)

[illegible] values checked and CN plotted

[illegible] to pages 7-10)

Brock Site

Stage Storage computations

Elev	Area Sq in	Area Acres	Average Area Acres	Interval Volume Acre ft	Storage due to Borrow	Total Interval Storage	Total Accum. Storage	Accum. sediment storage	Total Available storage
						2.64			
				5.96		5.96	2.64		
				9.24		9.24	8.60		
				13.92		13.92	17.84		
							31.76		
							59.		
							96.44		
							143.61	-4.	24.20
							199.56	-2.73	
							263.95	-5.61	
							337.60	-5.20	
1248		1930					420.46	-8.20	
			21.2	898	0	84.8	505.2		
1252	101.35	23.2							
			25.5	1020	0	102.0	607.2		
1256	121.37	228							

Elev 1230.0 Total Accum Storage = 115.5 ac-ft

1228.

84.1

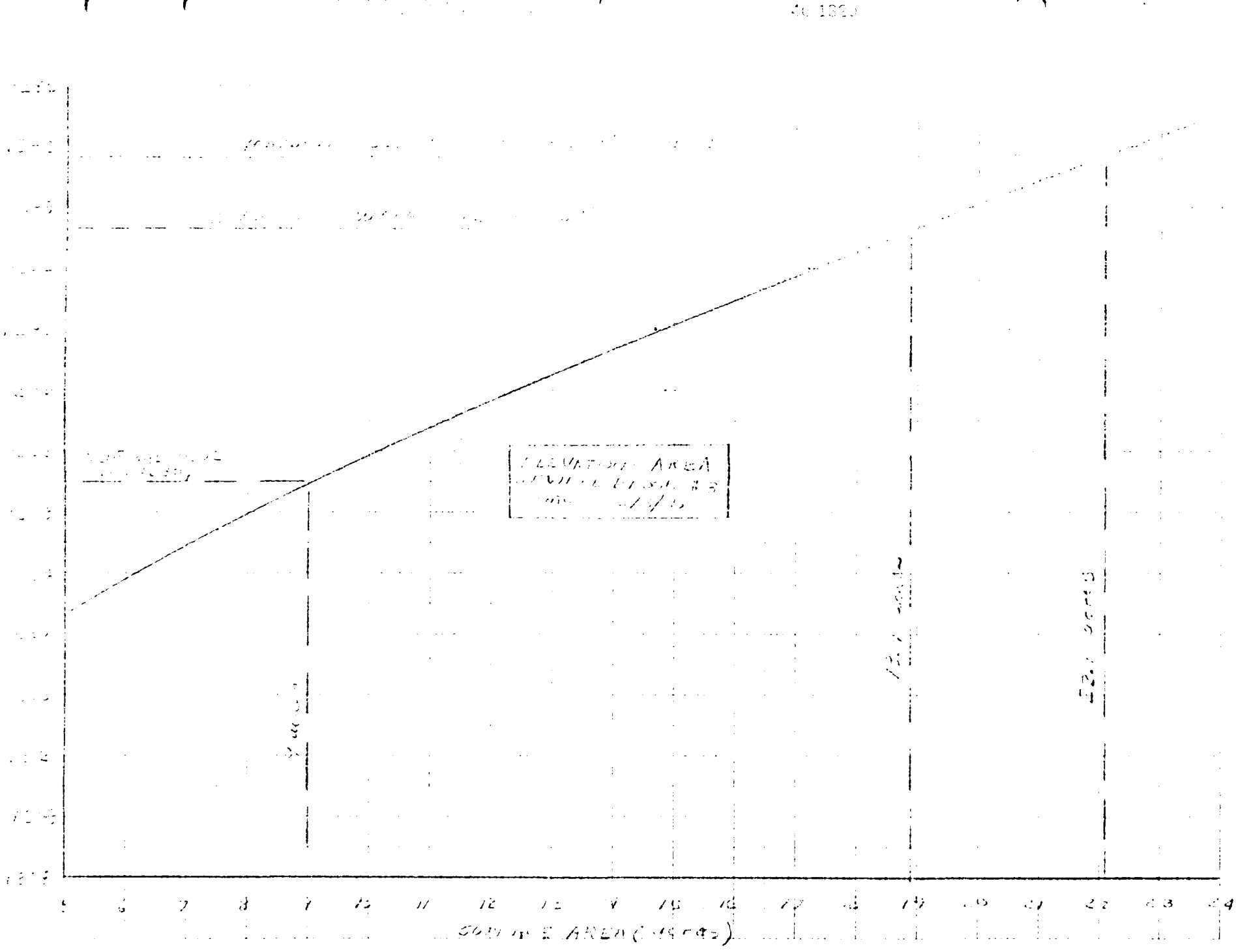
1248.5

1281.1

1294.9

1289.7

1311.7



Job No. 9113 Sheet 5 of 20
Project Jewett Brook #3 Date 2/8/80
Subject General By RNC Ch'k. by

JEWETT BROOK #3 - Located in Ludlow, VT

CLASSIFICATION SIZE - INTERMEDIATE (based upon dam height)

HAZARD - HIGH (Based upon numerous downstream homes)

BASIC DATA:

DRAINAGE AREA - 1.3 mi² = 840 acres

EMERGENCY SPILLWAY: NORMAL POOL LEVEL - 1230.0'
AREA - 9 acres
STORAGE - 115.5 a-f

DESIGN HIGH WATER LEVEL - 1246.7'
AREA - 16.9 acres
STORAGE - 387.5 a-f

MAXIMUM POOL LEVEL - 1251.5'
AREA - 21.1 acres
STORAGE - 532.0 a-f

EMBANKMENT, APPROX. 2½:1 US
3:1 US

LENGTH - 60.7'

WIDTH - 20' MIN

OUTLET WORKS: 24" RYDER 25'x7.5'
INVERT 1221.2'
CONC. BOX

EMBANKMENT IS TO BE SEEDED WITH w/
VEGETATIVE COVER

COMPUTATION SHEET
SCS-522 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—470648

STATE		PROJECT			
Vermont		JEWELL BROOK SITE 3			
BY	DATE	CHECKED BY	DATE	JOB NO.	
CMH	1/67	JWB	1/24/67		

SUBJECT

PRINCIPAL SPILLWAY RATING DATA

SHEET 1 OF 20

Low Stage = Orifice Flow

$Q = C A \sqrt{2gh}$

$Q = 2 \times 2 fs$

$K = 0.67$

$h = 9'$ to orifice invert

$A = \frac{2.3}{0.67 \times 8.025 \times 3.0}$

$A = 1.41 \text{ ft}^2$

C-C $1.0' \times 1.41'$ OK

or $2'0'' \times 1' 4\frac{15}{16}''$

$Q = 2.07 \times 1.4 \times 8.025 \times h^{1/2}$

$Q = 7.5 h^{1/2}$

Weir Flow

$Q = 3.1 (6.0) h^{3/2} = 46.5 h^{3/2}$

Pressure Flow in Conduit

30" ϕ RCP

$Q_P = C A_P h^{1/2}$

$L_P = 280'$

$Q_P = 4.91 D^2$

$n = 0.12$

$C = \sqrt{\frac{29}{1 + K_e + K_f L_P}}$

$K_f = 0.02922$ (FS-A)

$K_e = 1.0$

Outlet Elev 1186.25 ✓

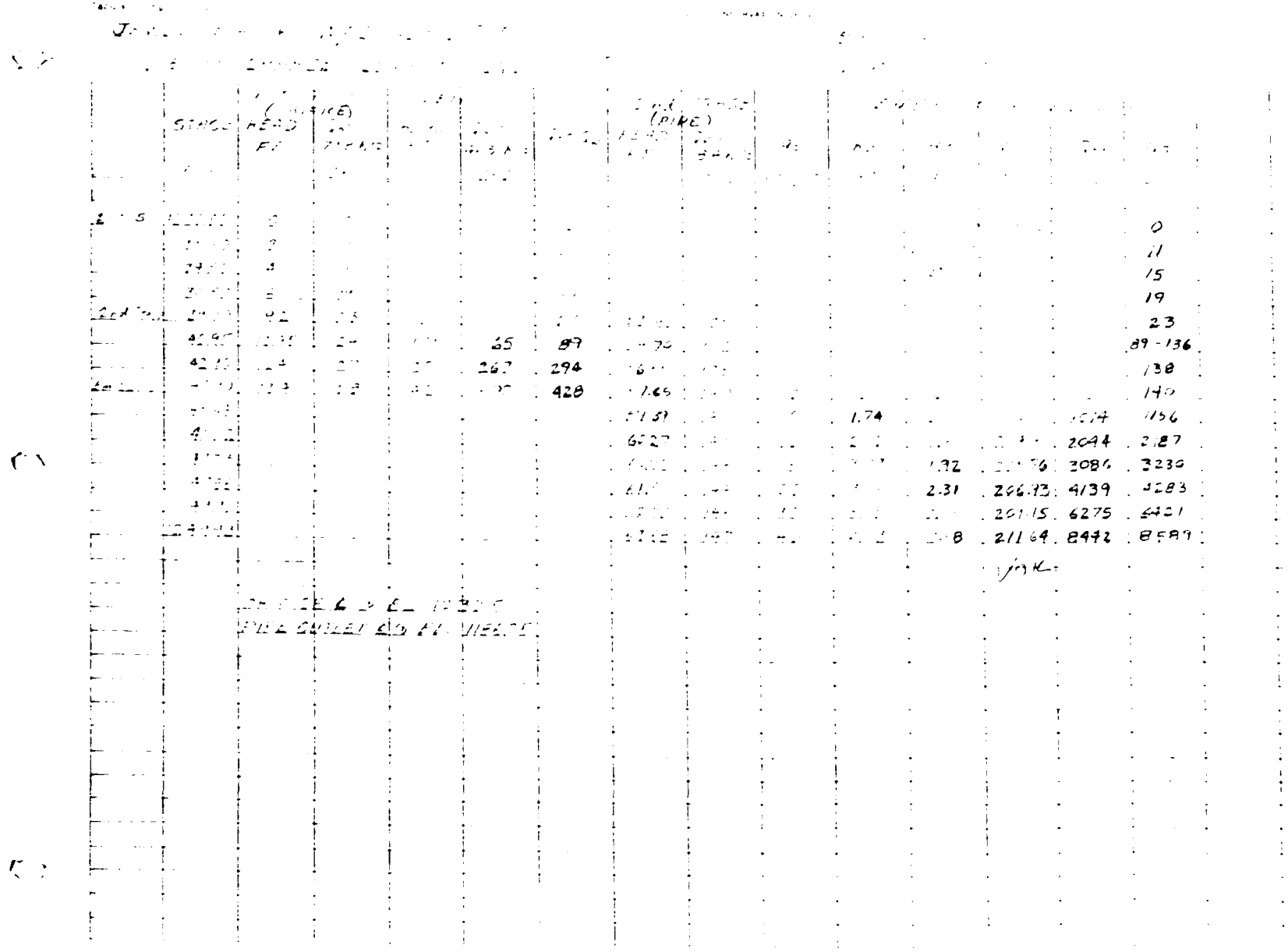
$= \frac{8.25}{\sqrt{1 + 1 + 280 (.02922)}}$

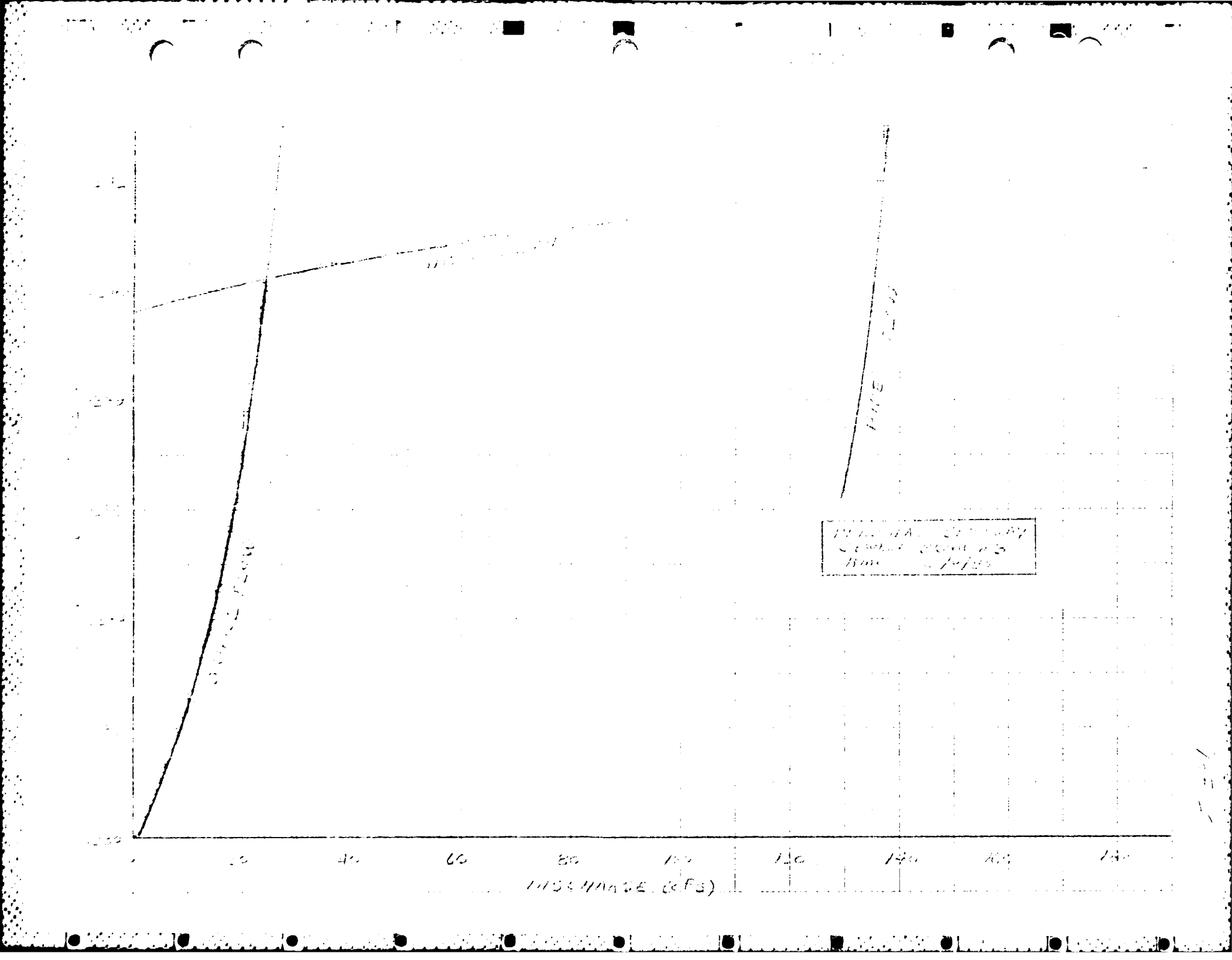
$C = 2.42$

$Q_P = 2.42 \times 4.91 \times h^{1/2}$

$Q_P = 11.9 h^{1/2}$

✓ EWR
3/10/67
W.C.





DuBois & King, Inc. ENGINEERING AND ENVIRONMENTAL SERVICES RANDOLPH VERMONT 05060

Job No. 71113 Sheet 11 of 20
Project Date 2/8/80
Subject By Ch'k. by

... 1241.4'

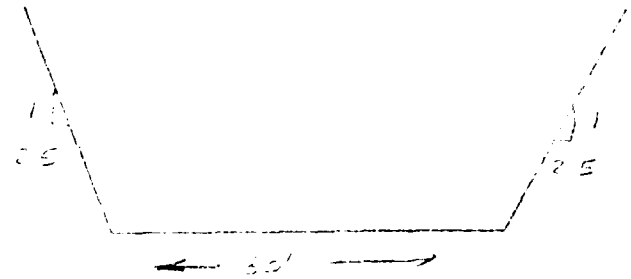
... 297.5 ...

4.16 ...

... 2597 ...

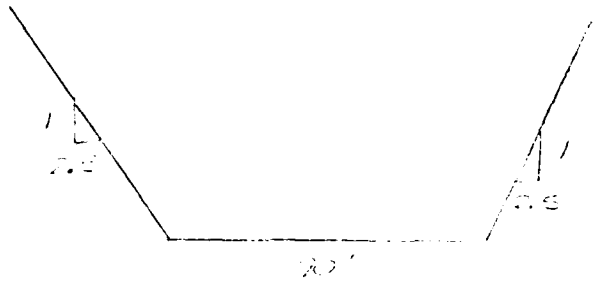
Job No. 7113
Project
Subject

Sheet 13 of 20
Date 2/11/80
By Ch'k. by



Job No. 7113
Project [illegible]
Subject [illegible]

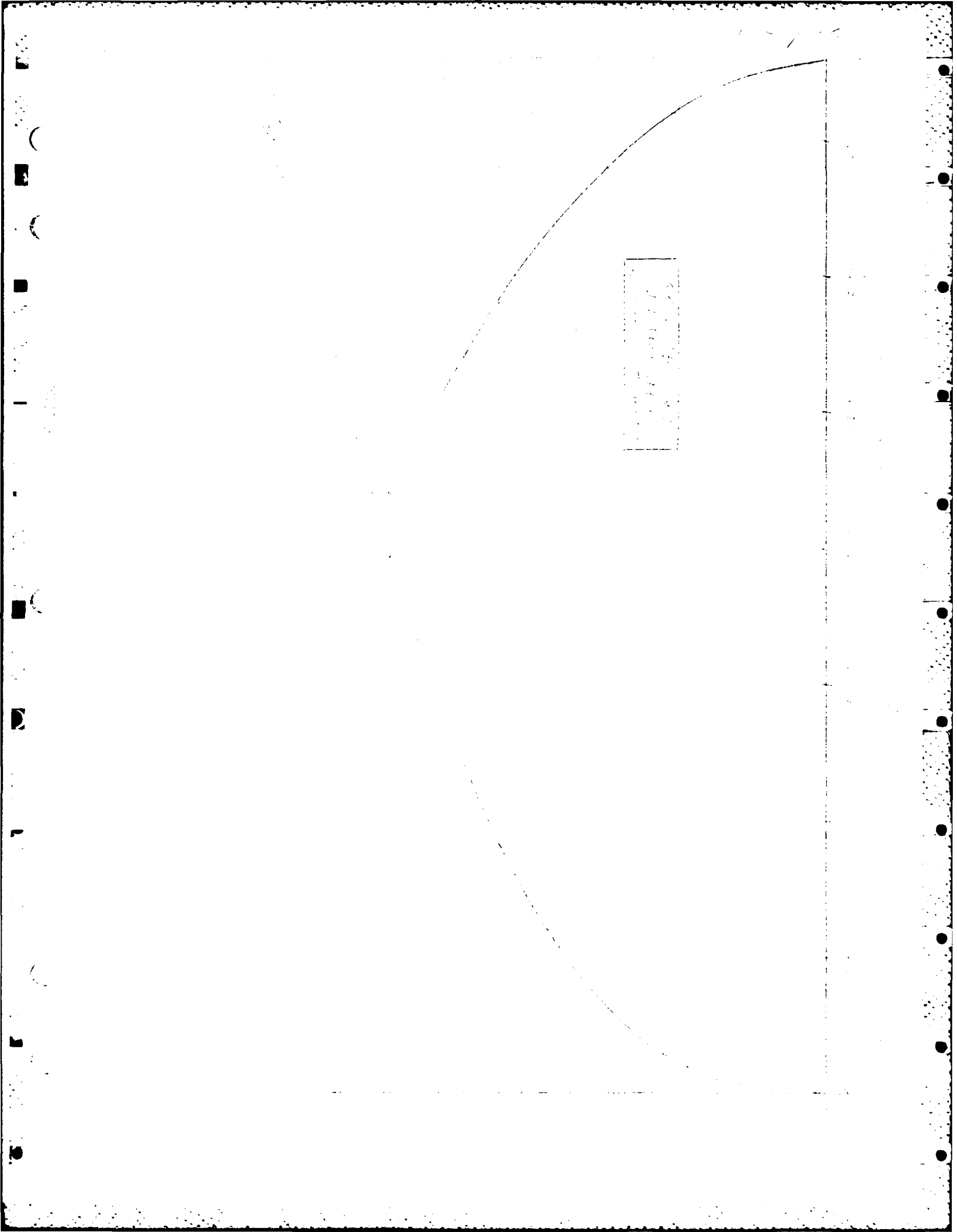
Sheet 15 of 20
Date 2/13/80
By [illegible] Ch'k. by [illegible]



Job No. 9112 Sheet 11 of 27
Project Date 4/11/92
Subject By Chk. by

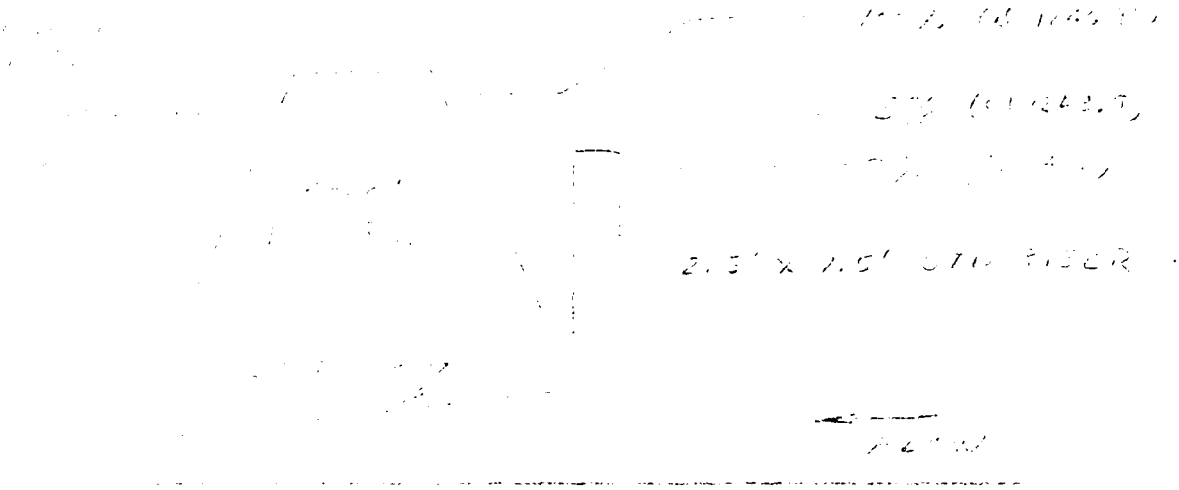
Job No.
Project
Subject

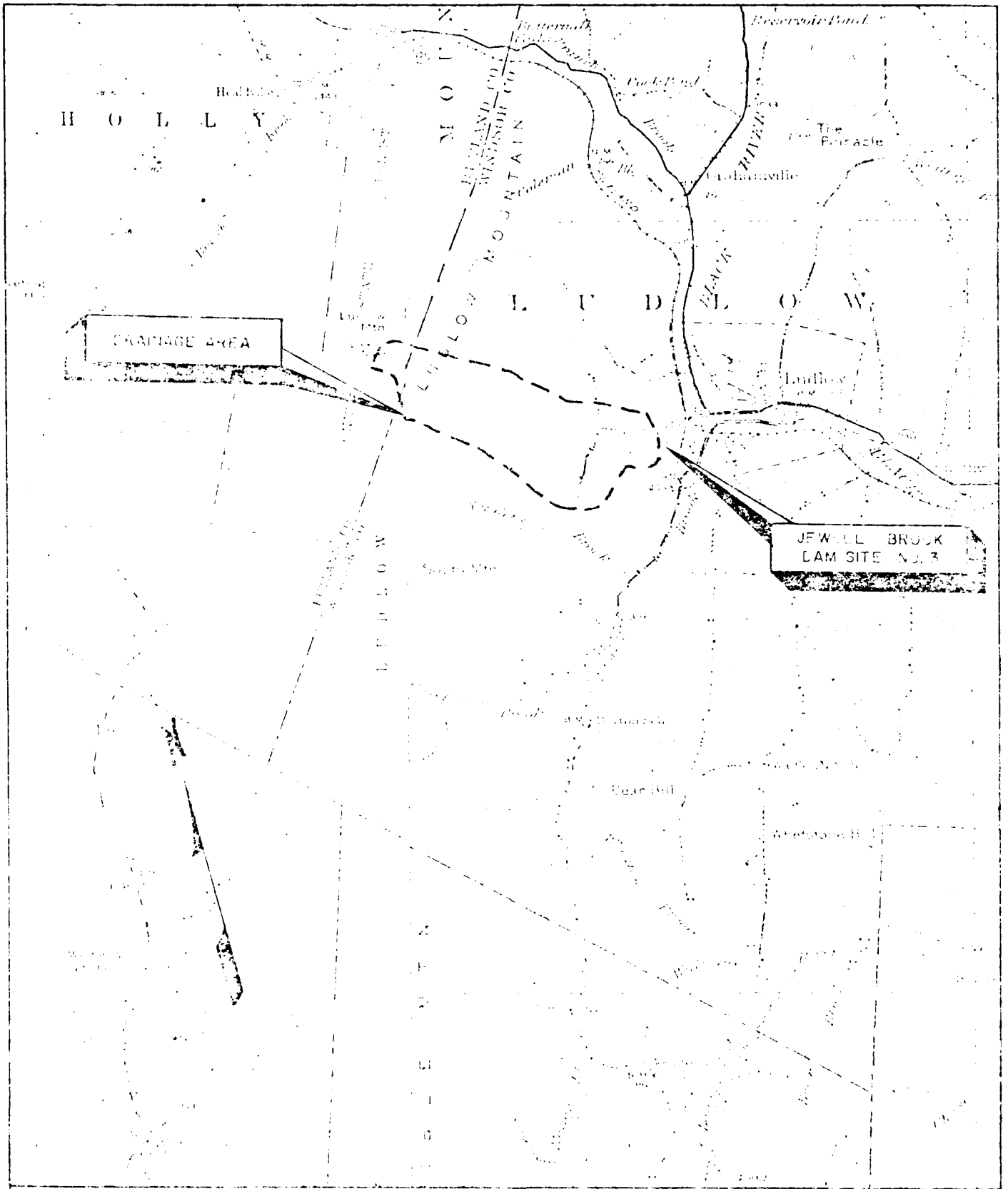
Sheet 1 of
Date
By Chk. by



Job No.
Project
Subject

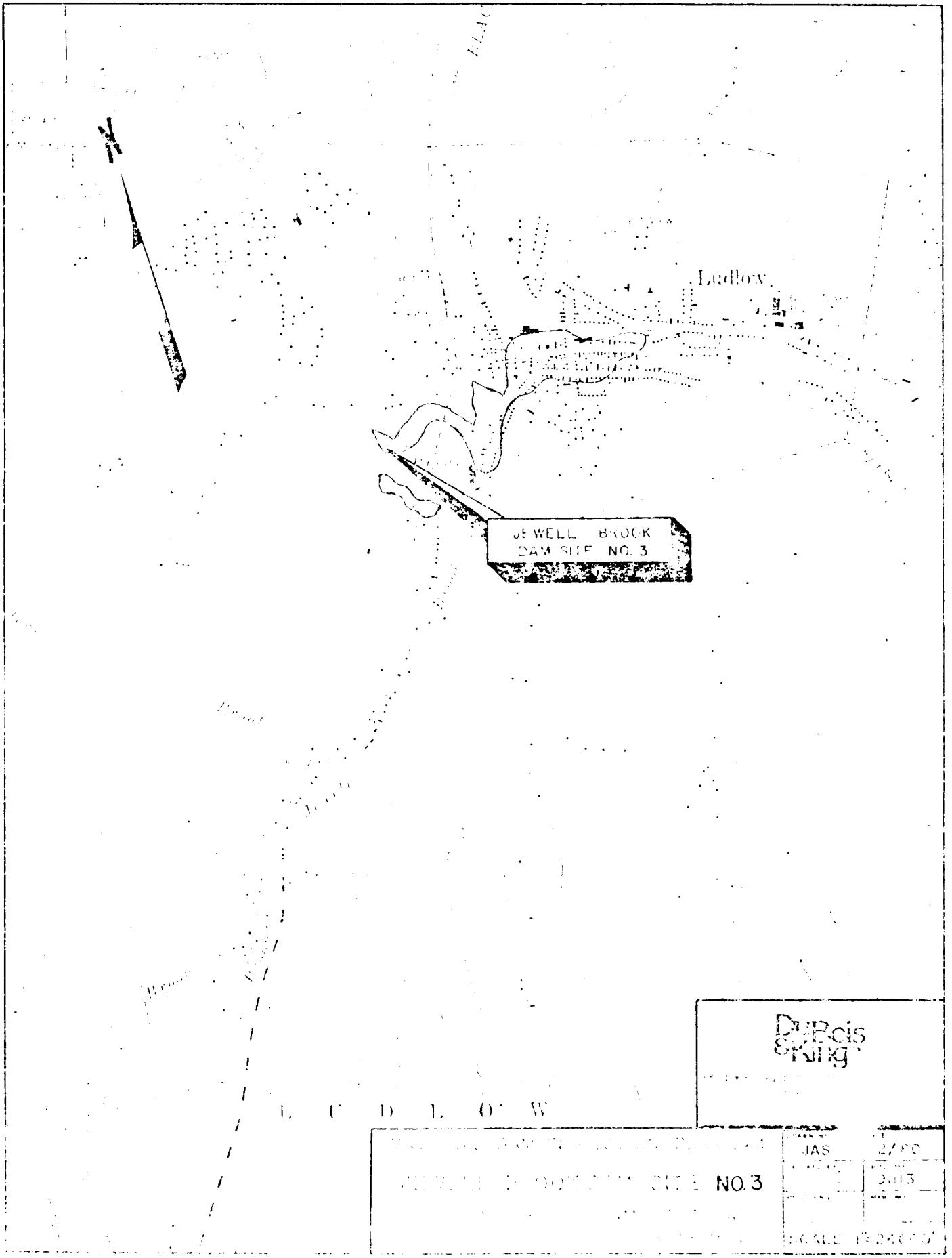
Sheet ___ of ___
Date
By ___ Ch'k. by ___





JEWELL BROOK DAM SITE NO. 3

JAS 2/80


Ludlow
JEWELL BROOK
DAM SITE NO. 3
DuBois
King
JAS
NO. 3

INVENTORY OF DAMS IN THE UNITED STATES

NAME

LATITUDE NORTH | LONGITUDE WEST | REPORT DATE DAY MO YR

NAME OF IMPOUNDMENT

RIVER OR STREAM

NEAREST DOWNSTREAM CITY-TOWN-VILLAGE

POPULATION

YEAR COMPLETED

PURPOSES

STRUCTURAL HEIGHT

HYDRAULIC HEIGHT

VOLUME OF DAM

SPILLWAY CAPACITY

RESERVOIR SURFACE AREA AT TOP OF NORMAL STORAGE

DRAINAGE AREA

NID | PRV/FED | SCS | A | VER/DATE

N | N | N | B

REMARKS

MAXIMUM DISCHARGE

POWER CAPACITY

NAVIGATION LOCKS LENGTH | WIDTH

OWNER

ENGINEERING BY

CONSTRUCTION BY

REGULATORY AGENCY

CONSTRUCTION

OPERATION

MAINTENANCE

INSPECTION BY

INSPECTION DATE DAY MO YR

AUTHORITY FOR INSPECTION

REMARKS

END

FILMED

8-85

DTIC